

CYBER 960 and 962 Site Preparation Mainframe Complex Data

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Manual History

New features, as well as changes, deletions, and additions to this manual, are indicated by vertical (change) bars in the margins.

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Revision	Change Order	Date	Reason for Change
A	-	April 1988	Manual released.
B	ECO 49764	July 1988	Manual revised; includes Engineering Change Order 49764 which includes new receptacle and system console part numbers.
C	ECO 50007	October 1988	Manual revised; includes Engineering Change Order 50007 which changes power wiring diagrams and power connector numbers.
D	ECO 50517	October 1989	Manual revised; includes Engineering Change Order 50517 which corrects false floor cutouts for the CPU placement, also includes TAR 292792. Because extensive changes are made, change bars and dots are not used and all pages reflect the latest revision level. This edition obsoletes all previous editions.

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About This Manual

This manual provides information for planning and preparing a computer site for the installation of the CONTROL DATA® CYBER 960 and 962 mainframe complexes.

Audience

The manual is for Control Data customer personnel or their representatives who are responsible for planning and carrying out the site preparation activities.

Terminology

This manual uses the following terms as described.

Computer room	A room with a controlled environment maintained to meet the requirements of the system equipment.
Site	The computer room and other building locations that may include one or more motor-generator (MG) sets and data media storage.
Mainframe complex	The power unit, central processing unit (CPU), input/output units (IOUs), system console, frequency converter or MG set, and MG interface unit.
Mainframe	The equipment units that contain the power unit, central processing unit (CPU) and the input output unit (IOU).
Power unit	A mainframe unit that contains 400-Hz power supplies that provide logic power to the CPU.
CPU	A mainframe unit that contains the central processor (CP-0) and optional second processor (CP-1), central memory (CM), central memory control (CMC), and optional memory increments.
IOUs	Mainframe units that contain peripheral processors and external channels.
Frequency converter	A motor generator mounted within its control cabinet.
MG interface unit	The electrical box that interfaces the power unit with the frequency converter or motor-generator set.
Motor-generator (MG) set	A standalone control cabinet and a separate motor generator (MG).
Must	A mandatory requirement.
Should	A recommendation that is advised but not required.

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Manual Organization

This manual contains sets of independent modules. Each module covers a single topic and contains a functional heading, one or more tables or figures, and additional paragraphs with detailed information on the topic. The modules in this manual are organized into six chapters and three appendixes.

Introduction

Chapter 1 lists the equipment in the mainframe complex, contains a site planning worksheet, and lists the symbols used in plan views and diagrams.

Space Requirements

Chapter 2 gives the space required for placing equipment at the site, space required for moving equipment to the site, and instructions for using scaled templates. The chapter contains a route planning worksheet.

Environmental Requirements

Chapter 3 specifies the planning requirements for the site air-conditioning system and acoustical treatment and contains an air-conditioning worksheet.

Power Requirements

Control Data computing equipment requires 50/60-Hz primary power from the site electrical service entrance and 400-Hz secondary power from one or more frequency converters or MG sets. Chapter 4 specifies the planning requirements for the site power distribution system and contains worksheets for 50/60- and 400-Hz power.

Communications Requirements

Chapter 5 specifies the planning requirements for the remote technical assistance (RTA) communications option.

Reports

Two reports must be filled in before the computer equipment is shipped. Chapter 6 contains the Site Data Report and the Site Readiness Report.

Data Sheets

Appendix A contains system console data sheets and appendix B contains RTA modem data sheets. The data sheets provide detailed planning data for the system console and RTA modem.

Grids and Templates

Appendix C contains scaled grids and templates of the mainframe complex equipment (except MG sets).

Related Manuals

This manual presents site preparation data for a Control Data mainframe complex. The manual is for use with the following manuals that describe general requirements for all computer systems and specific requirements for peripheral and communications equipment.

Control Data Computer Systems
Site Preparation General Information
(publication number 60275100)

Control Data Computer Systems
Site Preparation Peripheral Equipment Data
(publication number 60275300)

CDCNET Local Area Network
Installation
(publication number 60462870)

MG Interface Unit
Hardware Maintenance Manual
(publication number 60000124)

Ordering Manuals

You can order Control Data manuals from:

Control Data
Literature and Distribution Services
308 North Dale Street
St. Paul, Minnesota 55103-2495

Ordering information, prices, and the current revision levels are in the Literature Catalog (publication number 90310500).

Disclaimer

Site preparation information for system equipment operation is valid only as described in this manual and other referenced manuals and documents. Control Data cannot be responsible for problems that result from improper site preparation or from the customer's failure to comply with applicable building, electrical and fire codes or ordinances.

IT IS THE CUSTOMER'S RESPONSIBILITY TO ENSURE THAT APPLICABLE BUILDING, ELECTRICAL, AND FIRE CODES OR ORDINANCES ARE FOLLOWED.

Submitting Comments

The last page of this manual is a comment sheet. Please use it to give us your opinion of the manual's usability, to suggest improvements, and to report technical or typographical errors. If the comment sheet has already been used, you can mail your comments to:

Control Data
Technology and Publications Division ARH219
4201 Lexington Avenue North
St. Paul, Minnesota 55126-9983

Please indicate whether you would like a written response.

Introduction

1

What Equipment Is in the Mainframe Complex?	1-2
What Equipment Is Available for the Mainframe Complex?	1-4
What to Do Before the Equipment Arrives	1-9
What Symbols Are Used in Plan View and Diagrams?	1-13

This chapter contains a list of equipment in the mainframe complex, a site planning worksheet, and lists the symbols used in plan views and diagrams. Use the information in this chapter to acquaint yourself with what equipment is in the complex and what you must do before the equipment arrives.

What Equipment Is in the Mainframe Complex?

The physical units in a fully configured CYBER 960 or 962 mainframe complex consist of the equipment listed in table 1-1. Figure 1-1 shows the mainframe complex units, except for the frequency converter or MG set and RTA modem, if present.

Table 1-1. CYBER 960 or 962 Mainframe Complex Units

Unit	Note	Quantity
Mainframe:		
• Power Unit		1
• Central Processing Unit (CPU)	1	1
• Input/Output Unit (IOU)	1	1
Optl IOU Expansion	1	1
Optl Standalone IOU	1	1
Optl Standalone IOU Expansion	1	1
System Console		1
MG Interface Unit	2	1
Frequency Converter or Motor-Generator (MG) Set		1
RTA Modem		1

Notes:

1. When options are part of the configured equipment, they are physically contained within the units listed.
2. The CYBER 960 or 962 mainframe controls its associated MG set through a Control Data-supplied cable that connects to the MG interface unit. In special installations, connections may be made from the mainframe to other previously-installed system control devices. These connections permit the mainframe or one of the other devices to control two or more system MG sets from one location. The special installation connections are nonstandard. For details of these connections, you must contact your Control Data sales representative.

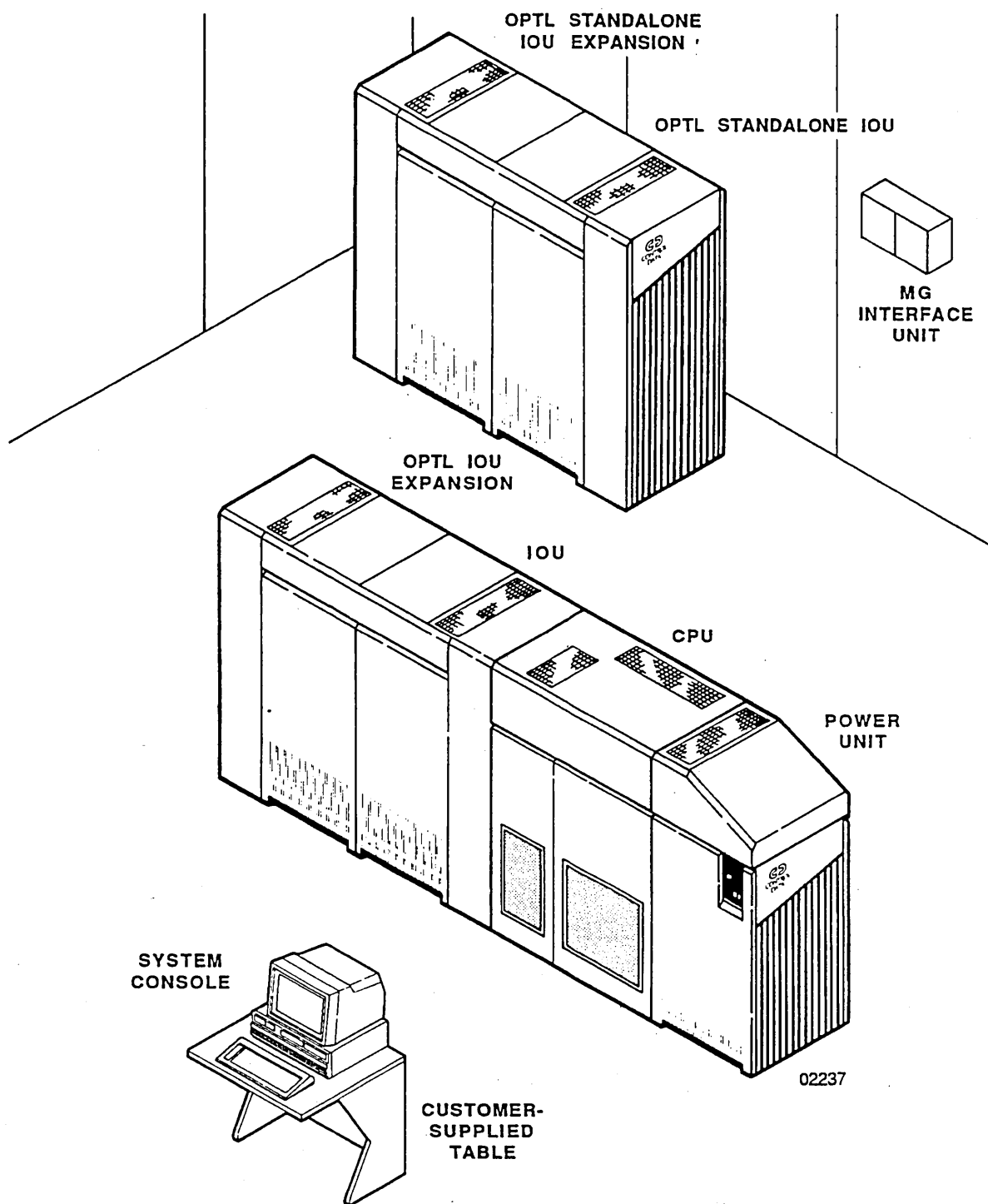


Figure 1-1. CYBER 960/962 Mainframe Complex Units

What Equipment Is Available for the Mainframe Complex?

Table 1-2 lists the equipment available for the 960 and 962 mainframe complexes. Figure 1-2 shows the specific application of the equipment to the 960 and 962 mainframe complexes.

Table 1-2. Available Equipment for Mainframe Complex

Product Number	Description	Configuration
Mainframe Complex		
• Mainframe	Includes:	
	- Power unit.	One of three mainframe units
	- CP-0.	One of three mainframe units
	- IOU (960 is dual state for NOS and NOS/VE; 962 is single state for NOS/VE).	One of three mainframe units
System Console		
• 19003-2 (applies to 962)	Includes: a monitor keyboard, and microprocessor.	Tabletop unit
• 19003-3 (applies to 960)	Includes: a monitor keyboard, and microprocessor.	Tabletop unit
Frequency Converter or MG Set		
• 10513-725 or	25-kVA frequency converter, converts 60-Hz power to 400 Hz.	One standalone unit
• 10513-740 or	40-kVA MG set, converts 60-Hz power to 400 Hz.	Two standalone units
• 10514-725 or	25-kVA frequency converter, converts 50-Hz power to 400 Hz.	One standalone unit
• 10514-740	40-kVA MG set converts 50-Hz power to 400 Hz.	Two standalone units
Optional Microcode		
• 19407-11 (applies to 960)	Optl CPU high-performance microcode upgrade.	Adds to base microcode in CPU
• 19407-13 (applies to 962)	Optl CPU high-performance microcode upgrade.	Adds to base microcode in CPU

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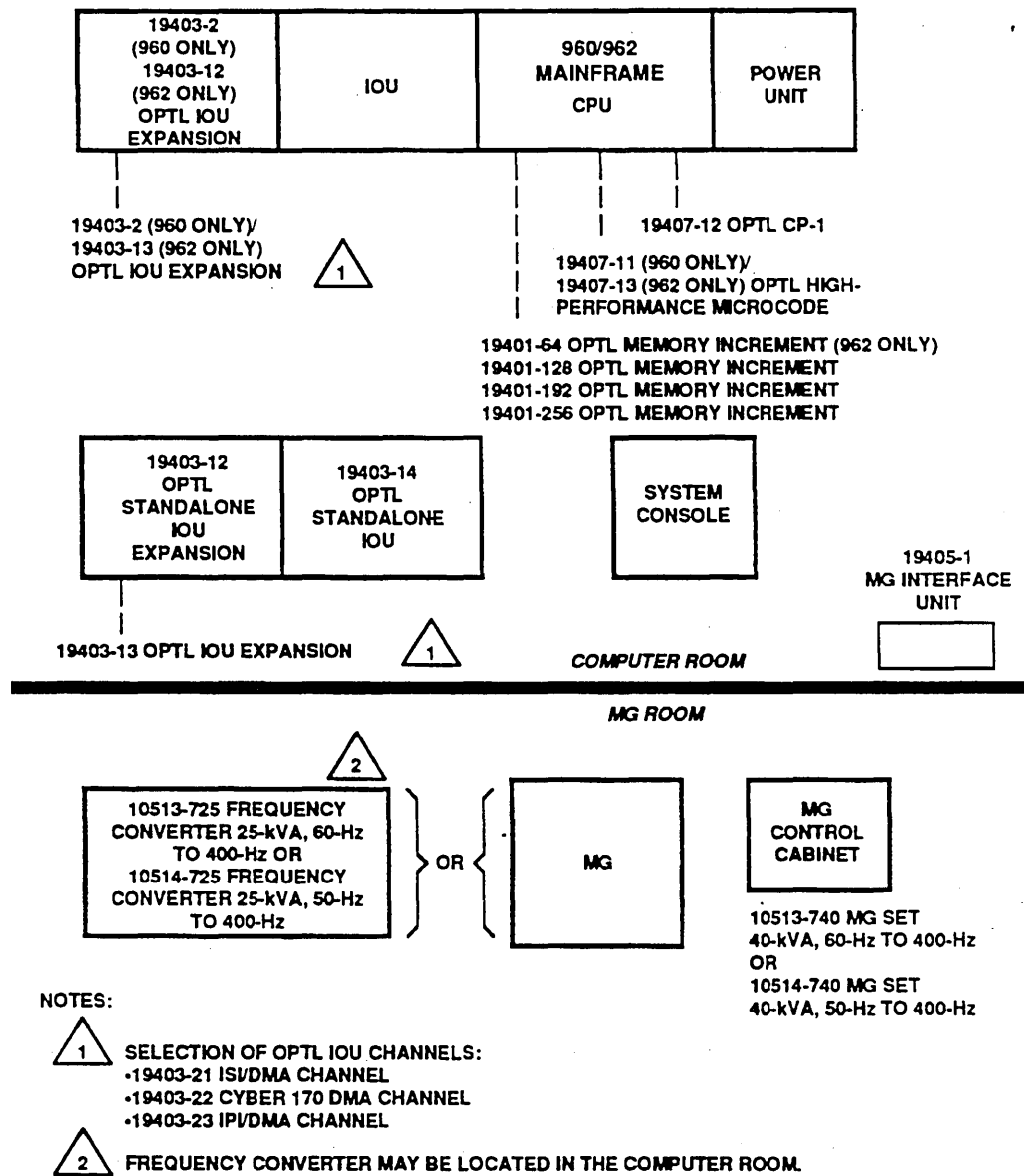
Table 1-2. Available Equipment for Mainframe Complex (Continued)

Product Number	Description	Configuration
Optional CP-1		
• 19407-12	Optl CP-1 upgrade.	Mounts in CPU
Optional CM Increments		
• 19401-64	Optl memory increment, adds 4M words (32 MB) to increase CM to 8M words (64 MB).	Mounts in CPU
• 19401-128	Optl memory increment, adds 8M words (64 MB) to increase CM to 16M words (128 MB).	Mounts in CPU
• 19401-192	Optl memory increment, adds 8M words (64 MB) to increase CM to 25M words (192 MB).	Mounts in CPU
• 19401-256	Optl memory increment, adds 8M words (64 MB) to increase CM to 33M words (256 MB).	Mounts in CPU
Optional IOU Expansions		
• 19403-2 (applies to 960)	Optl IOU expansion, adds 5 direct-memory-access (DMA) peripheral processors (PPs). Requires optl 19403-21/22/23 DMA channels to complement PPs.	Fourth mainframe unit
• 19403-3 (applies to 960)	Optl IOU expansion, adds 5 DMA PPs to 19403-2. Requires optl 19403-21/22/23 DMA channels to complement PPs.	Mounts in 19403-2
• 19403-12 (applies to 962 optl IOU expansion and optl standalone IOU expansion)	Optl IOU expansion, adds DMA PPs. Requires optl 19403-21/22/23 DMA channels to complement PPs.	Fourth mainframe unit and/or second unit of the optl standalone IOU
• 19403-13 (applies to 962 optl IOU expansion and optl standalone IOU expansion)	Optl IOU expansion, adds DMA PPs to 19403-12. Requires optl 19403-21/22/23 DMA channels to complement PPs.	Mounts in 19403-12
Optional Standalone IOU		
• 19403-14	Optional standalone IOU, adds 10 DMA PPs. Requires optl 19403-21/22/23 DMA channels to complement PPs.	Standalone unit

(Continued)

Table 1-2. Available Equipment for Mainframe Complex *(Continued)*

Product Number	Description	Configuration
Optional IOU Channels		
• 19403-21	ISI/DMA Channel.	Mounts in optl IOU expansion and optl standalone IOU expansion
• 19403-22	CYBER 170 DMA Channel.	Mounts in optl IOU expansion and optl standalone IOU expansion
• 19403-23	IPI/DMA Channel.	Mounts in optl IOU expansion and optl standalone IOU expansion
-	RTA modem - allows running of diagnostics from Control Data remote support office.	Tabletop unit



M02241-1

Figure 1-2. CYBER 960/962 Mainframe Complex Equipment

What Equipment Is Available for the Mainframe Complex?

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What to Do Before the Equipment Arrives

Before the equipment arrives, you must prepare the computer room and the MG room to meet the space, environmental, power, and communications requirements of the mainframe complex and associated peripheral equipment. Use the following site planning worksheet to help you identify the requirements. For details, refer to the indicated chapter of this manual and to the Site Preparation General Information and Peripheral Equipment Data manuals.

During your site planning and preparations, you may have questions about circumstances that are beyond the descriptions covered in this and other site preparation manuals. Your Control Data Engineering Services installation coordinator is available to answer these questions or direct you to appropriate resources.

Site Planning Worksheet (Sheet 1 of 3)

	Notes	Done
Space Requirements - See Chapter 2		
Plan equipment layout using scaled grids and templates. Consider:		
<ul style="list-style-type: none"> • Equipment area (present and future). • Service clearance. • Weight distribution clearance. • Other restrictions, such as cable lengths. • Operator access and workflow. 		
Order non-standard cables for peripheral equipment, if required.		
Mark location of equipment and floor cutouts on raised floor.		
Make cutouts in raised floor.		
Check obstructions on route from delivery truck to equipment site, and fill in route planning worksheet. Consider:		
<ul style="list-style-type: none"> • Doorway and hallway size. • Stairway or ramp size. • Elevator door size. • Elevator box size and capacity. 		
Make special arrangements to move equipment from delivery truck to site, if required.		

Site Planning Worksheet (Sheet 2 of 3)

	Notes	Done
--	-------	------

Environmental Requirements - See Chapter 3

Evaluate air conditioning system, and fill in air conditioning worksheets. Consider:

- Temperature.
- Relative humidity.
- Dewpoint.
- Heat output to air (present and future).

Install air conditioning system, or add to present system, if required.

Install environmental monitors and alarms.

Evaluate noise level.

Install acoustical treatment, if required.

Power Requirements - See Chapter 4

Evaluate site power distribution system, and fill in power worksheets. Consider:

- Input voltage.
- Power consumption (present and future).

Install power distribution system, or add to present system, if required.

- Install power and control wiring.
- Install safety grounds.

Install MG set(s) or frequency converter(s), and test in local mode. Check for proper rotation.

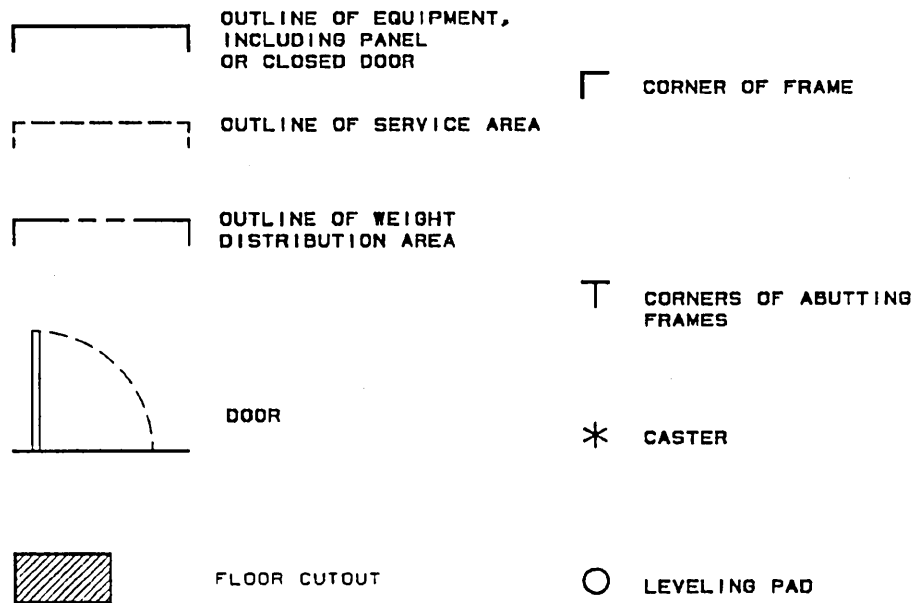
Site Planning Worksheet (Sheet 3 of 3)

	Notes	Done
Install customer-supplied power cord plugs, connectors, receptacles, disconnects, circuit breakers, circuit-breaker panels, magnetic contactors, emergency-off switches, and convenience outlets for test equipment.	_____	_____
Prepare diagram of site power distribution system. Identify by number the equipment, circuit breakers, and circuit-breaker panels.	_____	_____
Communications Requirements - See Chapter 5		
Install telephone line, telephone jack, and telephone, if RTA modem is ordered.	_____	_____
Report - See Chapter 6		
Fill in Site Data Report, and send to Technical Services installation coordinator 45 days before delivery of mainframe.	_____	_____
Fill in Site Readiness Report 2 weeks before delivery of mainframe.	_____	_____

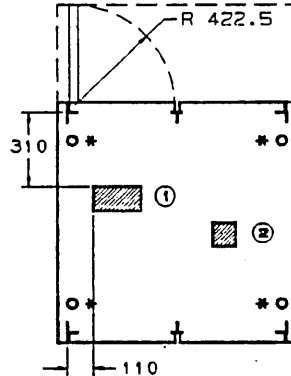
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What Symbols Are Used in Plan View and Diagrams?

Figure 1-3 shows the symbols used in equipment plan views and diagrams.



FLOOR CUTOUTS ARE
DIMENSIONED FROM
UNIT FRAMES.



EXAMPLE

60000119-16

Figure 1-3. Plan-View Diagram Symbols

Space Requirements

2

How to Use the Scaled Grids and Templates to Plan the Layout	2-2
What Space Is Required for Equipment in the Computer Room?	2-4
Space Under Computer Room Equipment	2-4
Space Around Computer Room Equipment	2-8
What Space Is Required for Equipment in the MG Room?	2-14
Space Under MG Room Equipment	2-14
Space Around MG Room Equipment	2-20
What Are Restrictions on Locating Equipment?	2-25
Placement of Equipment Based on Cable Lengths	2-25
Placement of Mainframe Based on Air Inlets	2-28
What Floor Cutouts Are Required?	2-30
What Space Is Required to Move Equipment to the Site?	2-32

This chapter contains physical specifications of the mainframe complex equipment and a route planning worksheet.

Chapter 2 of the Site Preparation Peripheral Equipment Data manual contains physical specifications of the peripheral equipment.

Chapter 2 of the Site Preparation General Information manual contains information on site location, space considerations, site construction, and site protection.

Use the information in these manuals to plan the equipment layout and the route from the delivery truck to the site.

How to Use the Scaled Grids and Templates to Plan the Layout

To plan the equipment layout using the Control Data-supplied scaled grids and templates, you will need to draw the computer room features on the grids, and place the templates on the grids. Place the templates as shown in figure 2-1. Consider future space requirements when you plan the layout.

To help you plan the equipment layout for the raised floor of the computer room, floor grids and equipment scaled templates are in appendix C of this manual. Peripheral equipment templates are in appendix B of the Site Preparation Peripheral Equipment Data manual. The grids and templates are scaled 12 mm = 600 mm (1/50 scale) for SI metric units and 1/2 in = 24 in (1/48 scale) for U.S. customary units. The templates are transparent, self-adhesive, and removable from the grids.

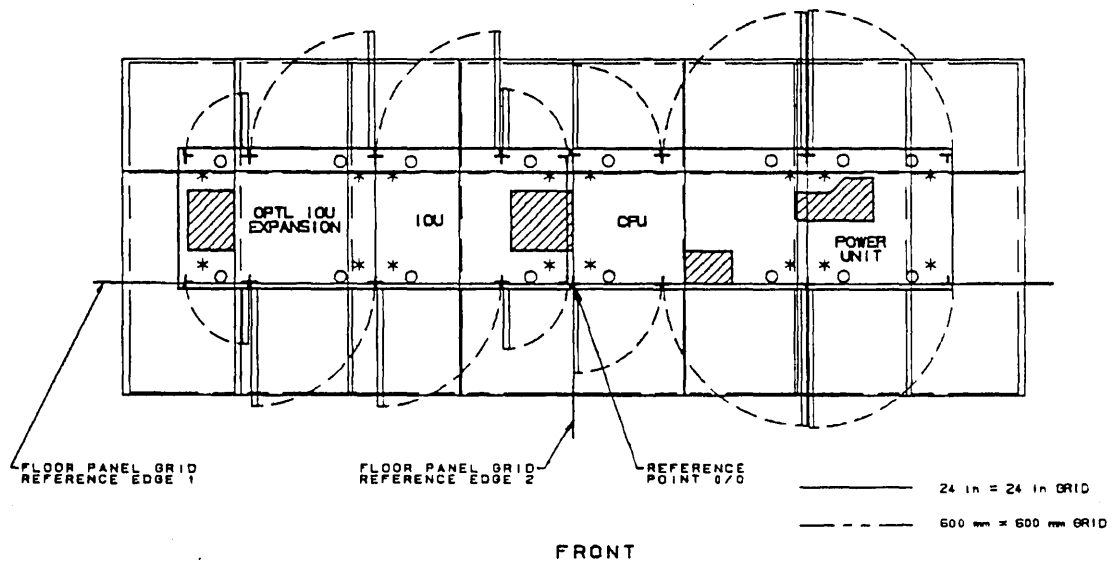
The grids show the 600-mm x 600-mm floor panels and the 24-in x 24-in floor panels. The templates show plan views of the mainframe complex equipment (except MG sets) and the peripheral equipment. The templates also show the service clearance and weight distribution clearance (where applicable) around the equipment. For definitions of service clearance and weight distribution clearance, refer to Equipment Floor Plan in chapter 2 of the Site Preparation General Information manual.

1. Remove the appropriate grids and scaled templates from this manual and the Site Preparation Peripheral Equipment Data manual. You can use the Control Data-supplied grids, draw your own grid, or buy grid paper from a store that sells office or engineering supplies.
2. When using the supplied grids, trim the blank edges from the grid sheets, and join them together as necessary to accommodate the size of the computer room.

NOTE

The grids are accurately drawn to the same scale as the templates. To preserve the accuracy, do not copy the grids on your office copier.

3. On the grid, draw the walls, doors, obstructions, convenience outlets, and telephone jacks in the computer room. Be sure to draw the walls accurately. Partial floor panels may be next to the walls.
4. Place the scaled templates on the grid.
 - For placement recommendations, refer to Equipment Floor Plan in chapter 2 of the Site Preparation General Information manual.
 - For placement restrictions, refer to What Are Restrictions on Locating Equipment? (in this chapter).
 - For placement of the mainframe and optional IOUs, refer to figure 2-1. Control Data recommends these placements to minimize cutting the floor grid structure and maximize access to the cutouts in the equipment frame.
 - Consider future space requirements.



NOTE:

FLOOR PLACEMENT OF THE OPTIONAL STANDALONE IOU AND STANDALONE IOU EXPANSION (NOT SHOWN) ARE THE SAME AS FOR THE IOU AND OPTIONAL IOU EXPANSION, AS REFERENCED FROM SIMILAR REFERENCE GRIDS 1 AND 2 THAT ESTABLISH A REFERENCE POINT 0/0 FOR THE STANDALONE UNITS.

60000119-01A

Figure 2-1. Placing Mainframe and Optional IOUs

What Space Is Required for Equipment in the Computer Room?

The computer room requires space under and around the equipment.

The design of the 25-kVA frequency converter permits its placement in the MG room or the computer room, depending on your site requirements. If you plan on installing the frequency converter in the computer room, you must refer to the converter data in this chapter under What Space is Required for Equipment in the MG Room.

The MG interface unit mounts on a wall in the computer room.

Space Under Computer Room Equipment

Table 2-1 lists the equipment width, depth, height, operational weight, and distributed floor loading. From these dimensions, you can figure the floor space required by the equipment and the equipment floor loading requirements. Figures 2-2 and 2-3 show the equipment dimensions.

Operational weight includes:

- Weight of the equipment.
- Half the weight of power and signal cables that connect to the equipment.

Distributed floor loading is the result of:

- Adding the operational weight to the weight of the raised floor (under equipment plus one-half of service clearance) using 50 kg/m² (10 lb/ft²) for the weight of the raised floor.
- Dividing the sum of the weights by an area defined by the equipment and one-half of the service clearance.

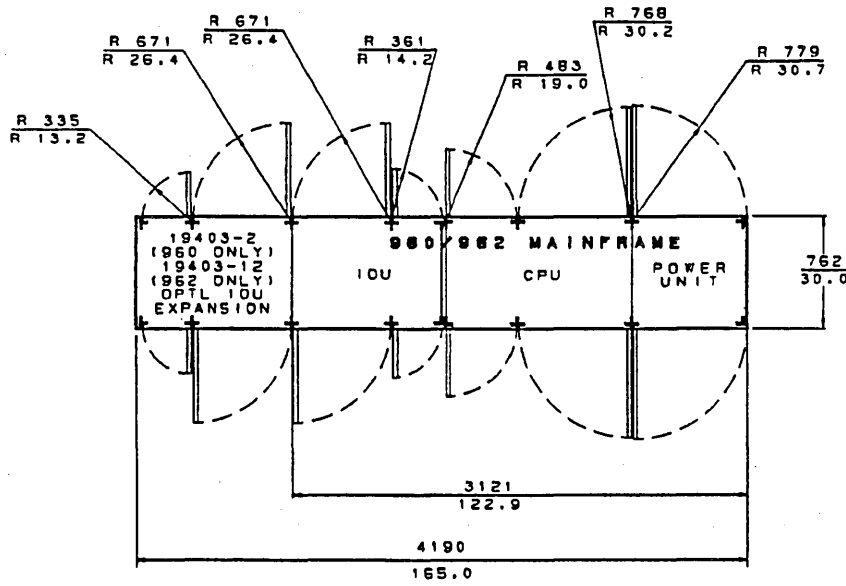
Table 2-1. Dimensions, Weight, and Floor Loading of Computer Room Equipment

Equipment	Note	Width mm (in)	Depth mm (in)	Height mm (in)	Operational Weight kg (lb)	Distributed Floor Loading kg/m ² (lb/ft ²)
Mainframe	1	3121 (122.9)	762 (30.0)	1930 (76)	1905 (4200)	386 (79)
Mainframe and 19403-2/19403-12 optl IOU expansion	2	4190 (165.0)	762 (30.0)	1930 (76)	2449 (5400)	376 (77)
19403-14 optl standalone IOU		1081 (42.6)	762 (30.0)	1930 (76)	544 (1200)	395 (81)
19403-14 optl standalone IOU and 19403-12 optl standalone IOU expansion	3	2150 (84.6)	762 (30.0)	1930 (76)	1089 (2400)	395 (81)
19405-1 MG interface unit		546 (21.5)	187 (7.0)	362 (14.2)	18 (40)	N/A
10513-725 or 10514-725 frequency converter	4	—	—	—	—	—
System console	5	—	—	—	—	—
RTA modem	6	—	—	—	—	—

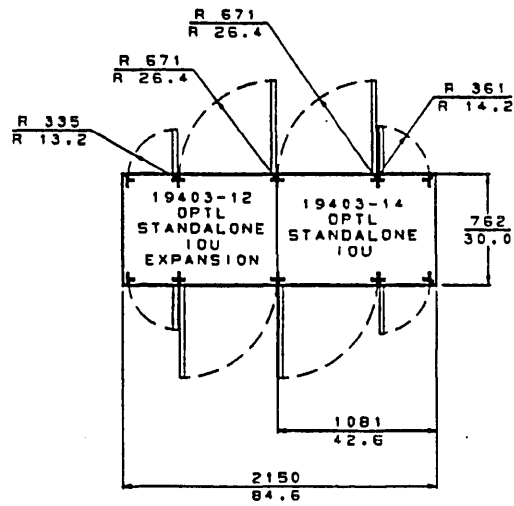
Notes:

1. Includes power unit, CPU, memory options, and IOU.
2. Includes power unit and CPU and memory and IOU options.
3. Includes IOU expansion options.
4. Refer to the frequency converter data in this chapter under, What Space is Required for Equipment in the MG Room.
5. Refer to system console data in appendix A.
6. Refer to RTA modem data in appendix B.

What Space Is Required for Equipment in the Computer Room?



FRONT



FRONT

60000119-9

Figure 2-2. Mainframe and Optional IOU Dimensions

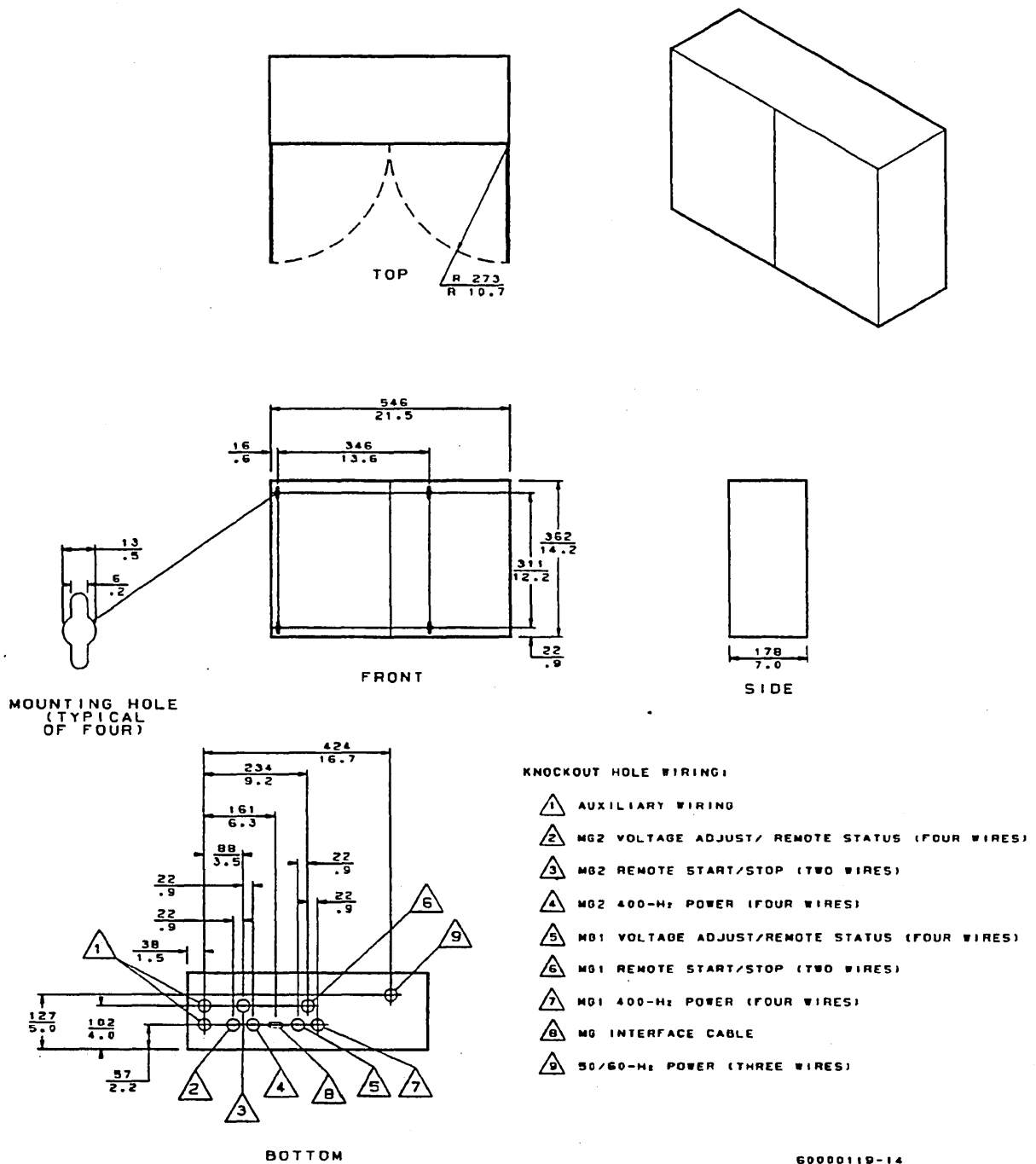


Figure 2-3. MG Interface Unit Dimensions

Space Around Computer Room Equipment

The equipment requires surrounding space for installing, maintaining, servicing, and circulating air. Surrounding space is also necessary to reduce the floor loading to 340 kg/m^2 (70 lb/ft^2). The minimum clearances for all equipment are in listed table 2-2. The service and weight distribution clearances are shown in figures 2-4 through 2-6. For definitions of service clearance and weight distribution clearance, refer to Equipment Floor Plan in chapter 2 of the Site Preparation General Information manual.

Table 2-2. Minimum Clearances for Computer Room Equipment

Equipment	Note	Front mm (in)	Rear mm (in)	Left mm (in)	Right mm (in)	Top mm (in)
Mainframe		833 (32.8)	833 (32.8)	0	610 (24.0)	610 (24.0)
19403-2/19403-12 optl IOU expansion		833 (32.8)	833 (32.8)	0	610 (24.0)	610 (24.0)
19403-14 optl standalone IOU		833 (32.8)	833 (32.8)	0	610 (24.0)	610 (24.0)
19403-12 optl standalone IOU expansion		833 (32.8)	833 (32.8)	0	610 (24.0)	610 (24.0)
19405-1 MG interface unit	1	610 (24.0)	N/A	0	0	610 (24.0)
10513-725 or 10514-725 frequency converter	2	-	-	-	-	-
System console	3	-	-	-	-	-
RTA modem	4	-	-	-	-	-

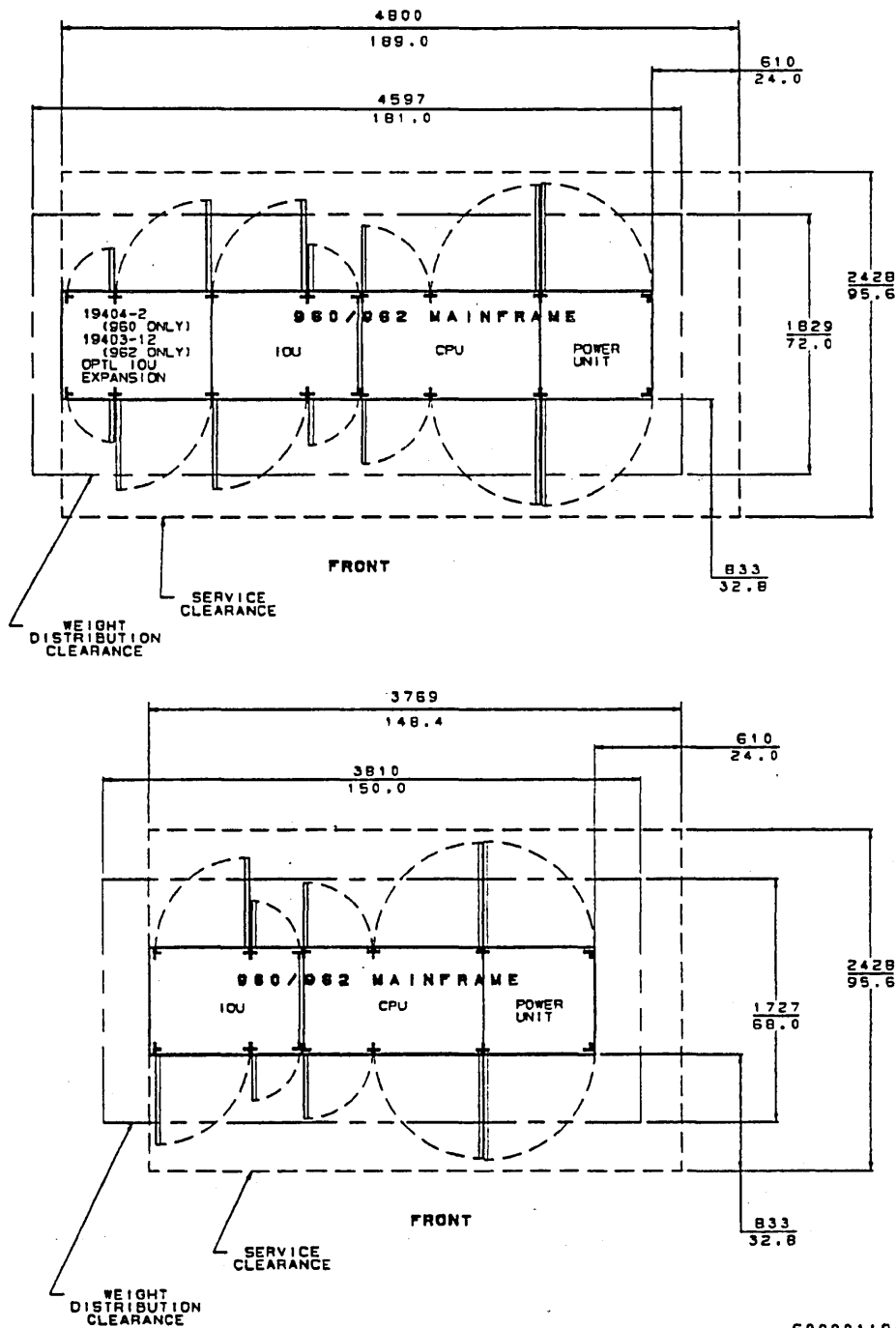
Notes:

1. MG interface unit requires a clearance for a cable connection that may be at top or bottom of the unit, depending on its mounting position.

2. Refer to the frequency converter data in this chapter under What Space is Required for Equipment in the MG Room.

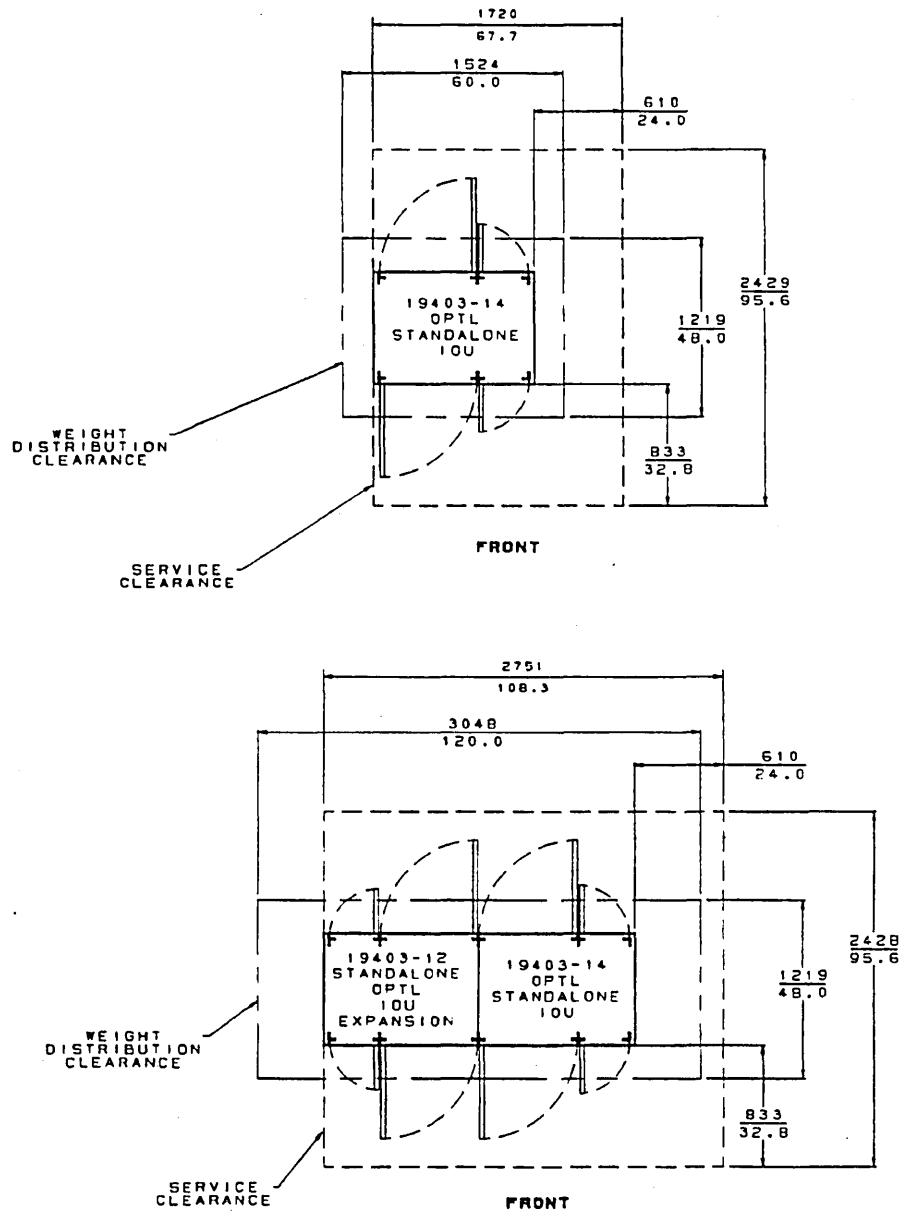
3. Refer to system console data in appendix A.

4. Refer to RTA modem data in appendix B.



60000119-10

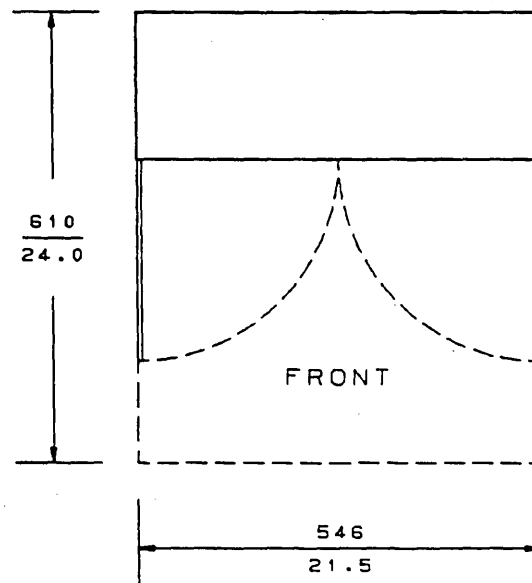
Figure 2-4. Clearances for Mainframe



60000119-6

Figure 2-5. Clearances for Optional IOUs

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NOTE:

THE WEIGHT DISTRIBUTION OF THE MG INTERFACE UNIT IS LESS THAN 340 kg/m^2 (70 lb/ft^2).

60000119-15A

Figure 2-6. Clearances for MG Interface Unit

What Space Is Required for Equipment in the MG Room?

The MG room requires space under and around the equipment.

Space Under MG Room Equipment

Table 2-3 lists the equipment width, depth, height, weight, and distributed floor loading. From these dimensions, you can figure the required space occupied by the equipment and its floor loading requirements. Figures 2-7 through 2-11 show the equipment dimensions.

Distributed floor loading is the result of dividing the weight of the equipment by the floor area it occupies and half its service clearance.

Table 2-3. Dimensions, Weight, and Floor Loading of MG Room Equipment

Equipment	Note	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)	Distrib- uted Floor Loading kg/m ² (lb/ft ²)
10513-725 (60-Hz) frequency converter	1	864 (34)	1524 (60)	1676 (66)	1295 (2850)	423 (86.7)
10514-725 (50-Hz) frequency converter	1	864 (34)	1524 (60)	1676 (66)	1477 (3250)	483 (99)
10513-740 MG set:						
• MG control cabinet, 40 kVA		813 (32)	584 (23)	1880 (74)	284 (625)	361 (74)
• and Kato MG, 40 kVA, 60 Hz		711 (28.0)	711 (28.0)	1445 (56.9)	1205 (2650)	862 (176.7)
10514-740 MG set:						
• MG control cabinet, 40 kVA		813 (32)	584 (23)	1880 (74)	284 (625)	361 (74)
• and Kato MG, 40 kVA, 50 Hz		711 (28.0)	711 (28.0)	1524 (60.0)	1338 (2950)	920 (188.5)
• or Piller MG, 40 kVA, 50 Hz		820 (32.3)	820 (32.3)	1435 (56.5)	1435 (3160)	786 (161)

Note:

1. The frequency converter may either mount in the MG room or in the computer room.

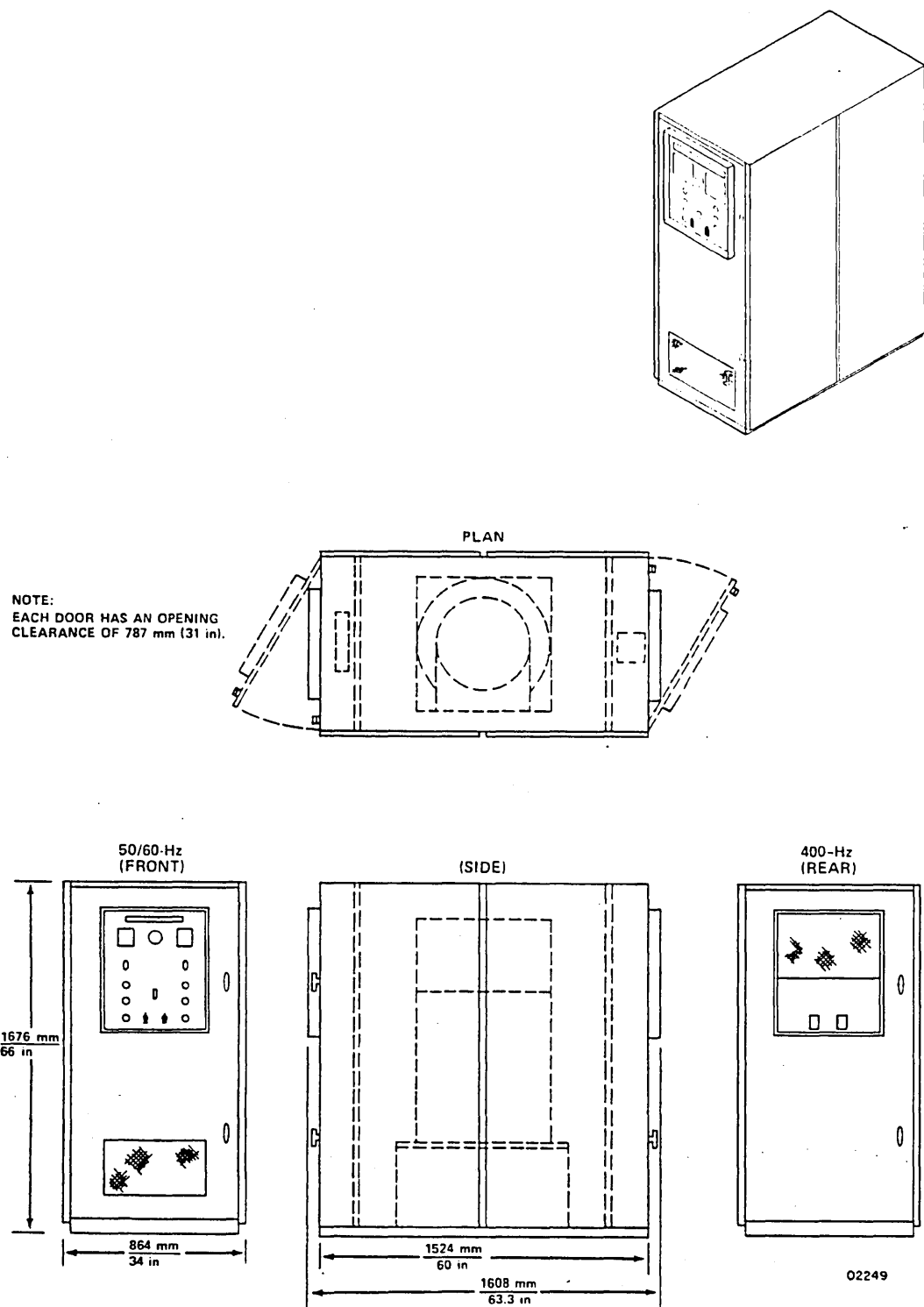


Figure 2-7. Frequency Converter Dimensions

What Space Is Required for Equipment in the MG Room?

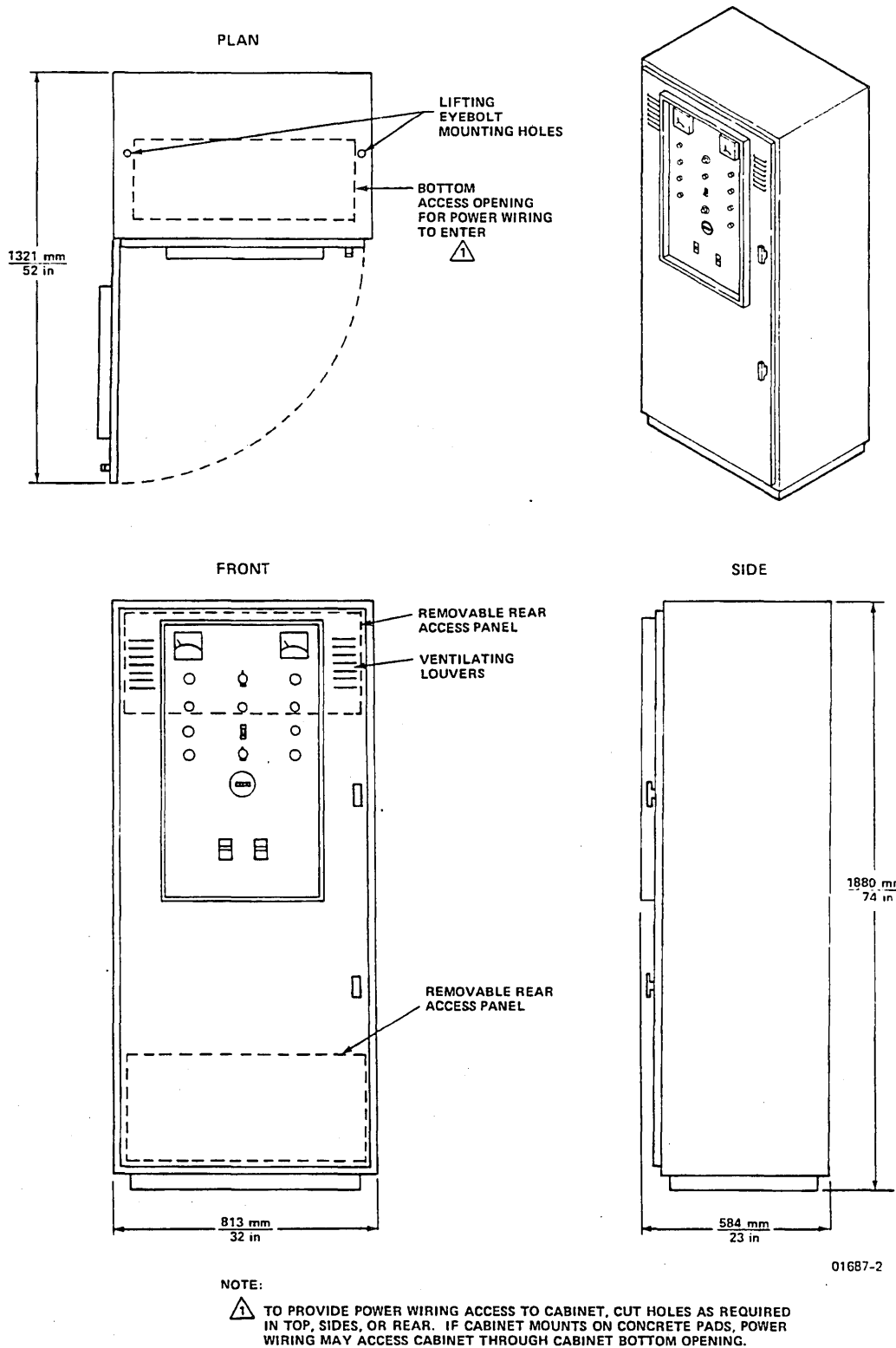
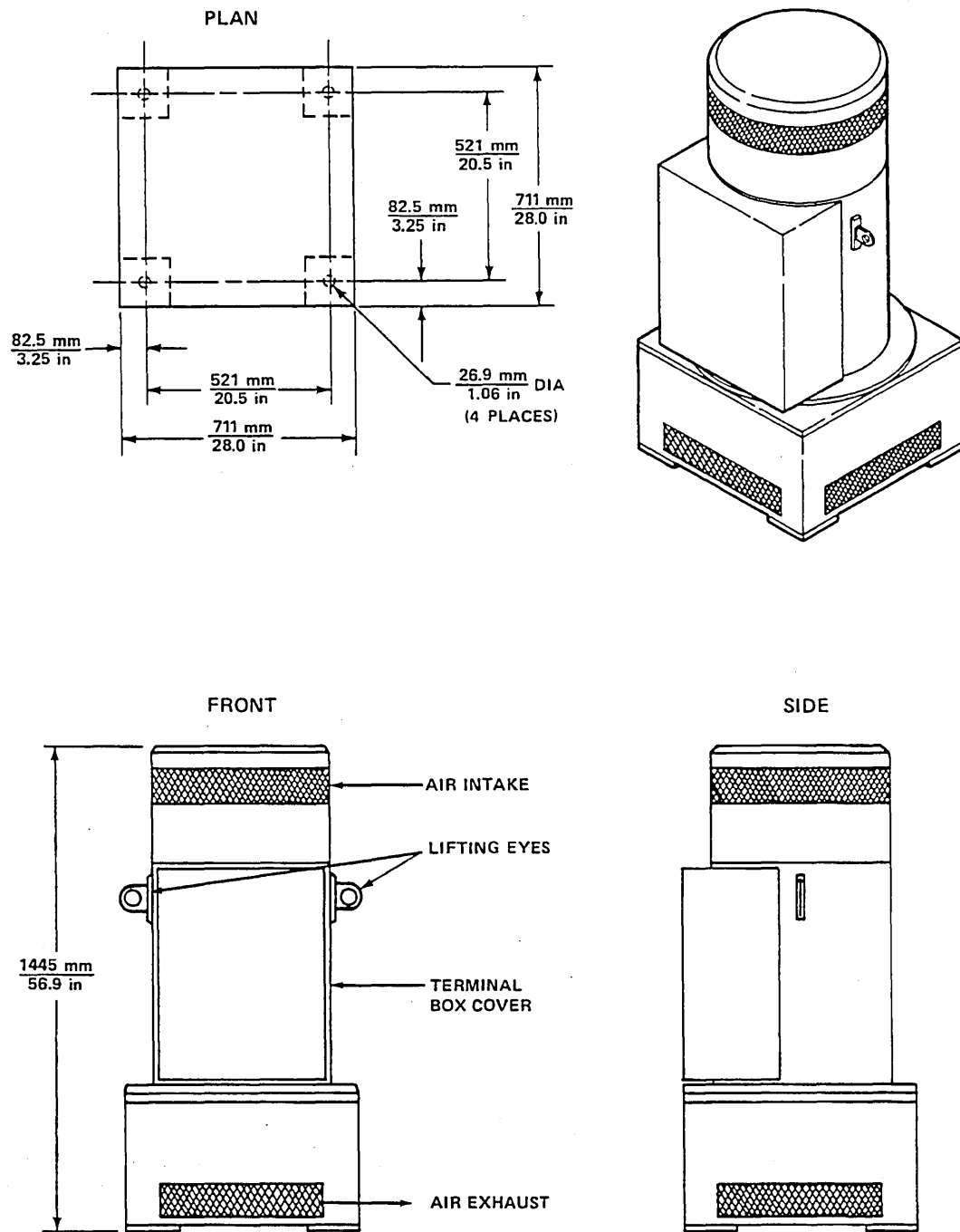


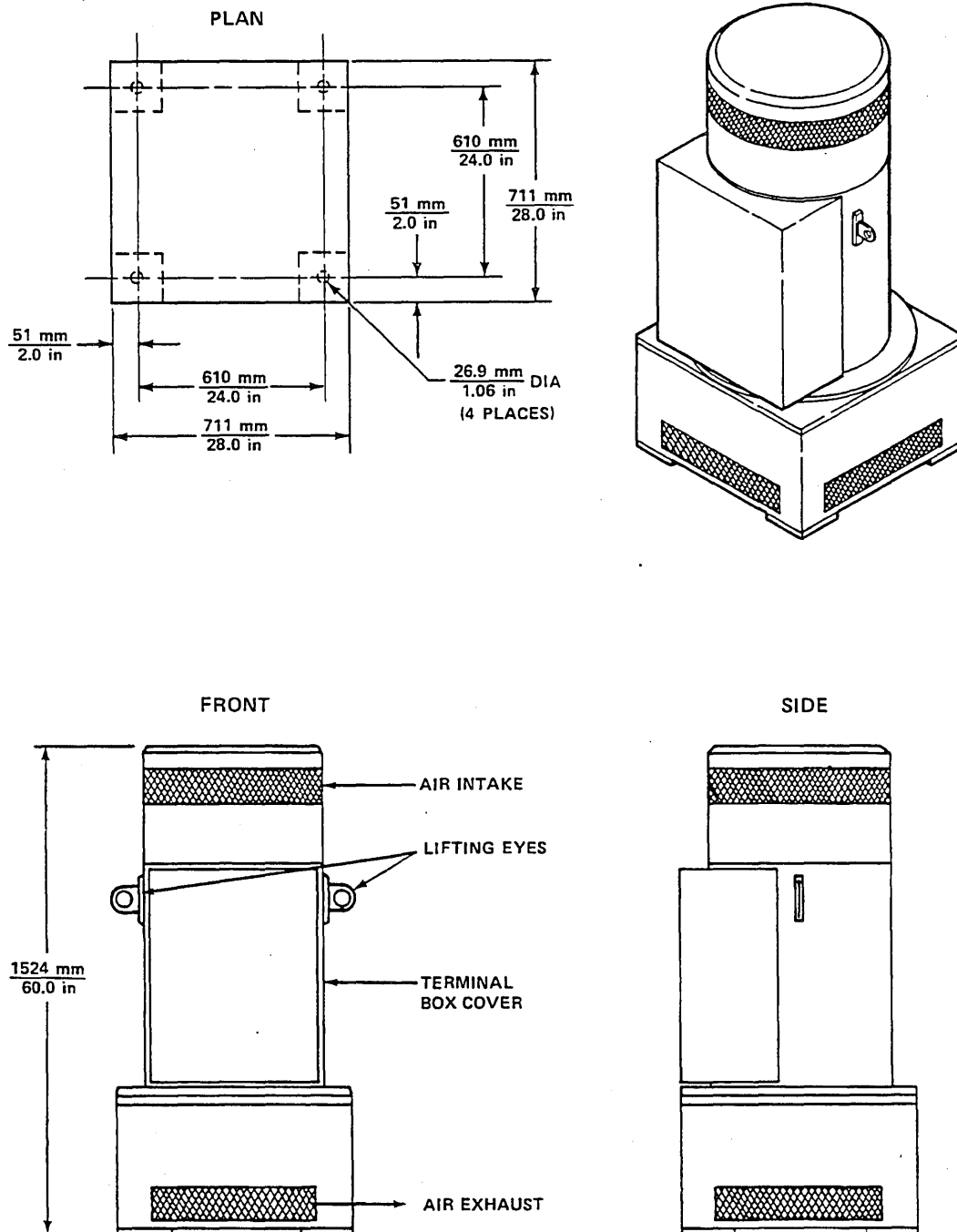
Figure 2-8. MG Control Cabinet Dimensions



NOTE:
TO PROVIDE POWER WIRING ACCESS TO MG TERMINAL BOX,
CUT HOLES AS REQUIRED IN TERMINAL BOX COVER.

Figure 2-9. Kato MG Dimensions, 60 Hz

What Space Is Required for Equipment in the MG Room?

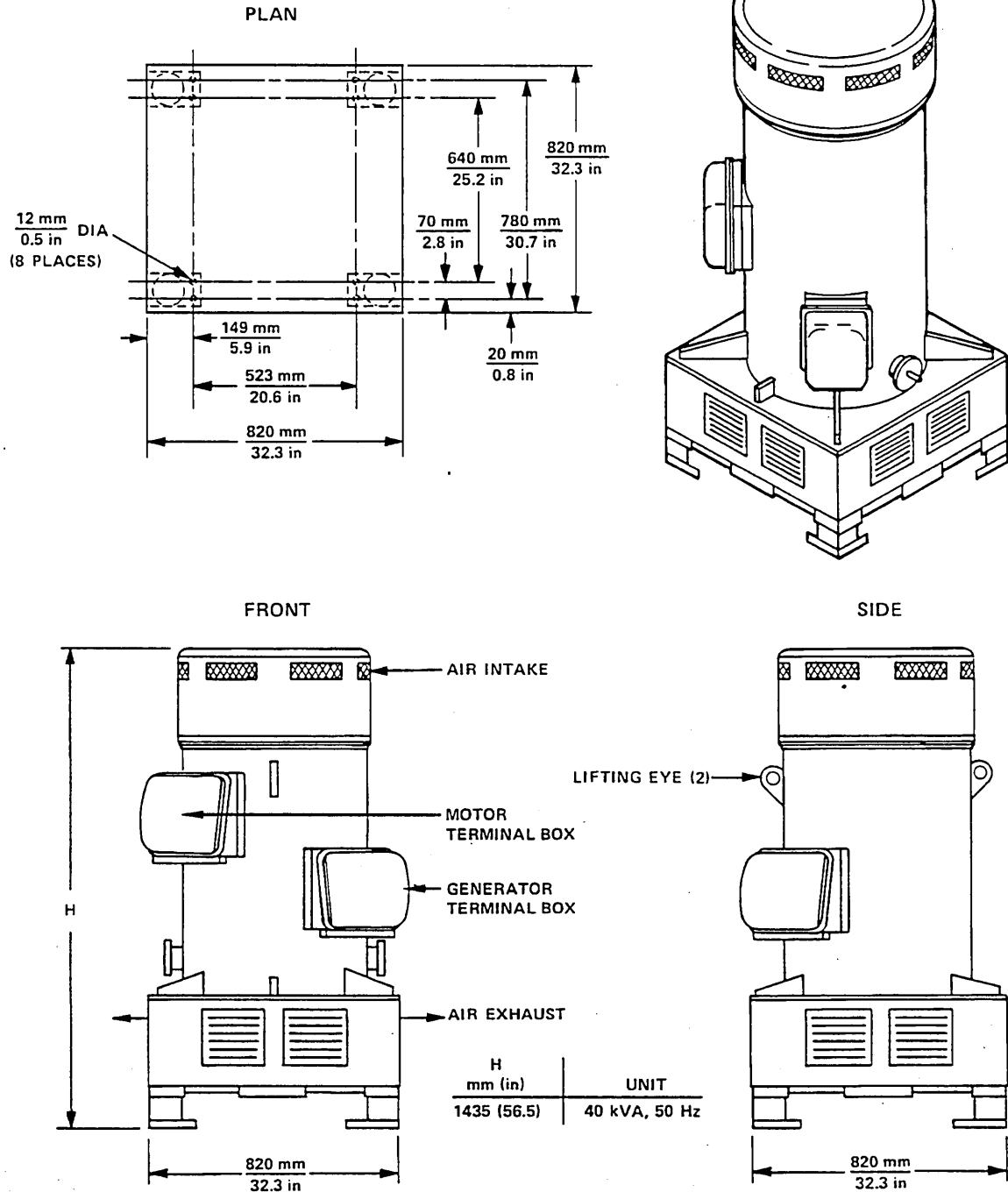


NOTE:

TO PROVIDE POWER WIRING ACCESS TO MG TERMINAL BOX,
CUT HOLES AS REQUIRED IN TERMINAL BOX COVER.

01685-1

Figure 2-10. Kato MG Dimensions, 50 Hz



01684-3

Figure 2-11. Piller MG Dimensions, 50 Hz

Space Around MG Room Equipment

The MG room requires space for installing, maintaining, servicing, and circulating air around equipment. The minimum clearances are listed in table 2-4. Figure 2-12 identifies the fronts of the frequency converter and MGs. Additional space is necessary around the MG to reduce the distributed floor loading to 340 kg/m² (70 lb/ft²). The weight distribution clearances are listed in table 2-5. For definitions of service clearance and weight distribution clearance, refer to Equipment Floor Plan in chapter 2 of the Site Preparation General Information manual.

Depending on site requirements, installation of the frequency converter may be in the computer room instead of the MG room. For this purpose, figure 2-13 shows the service and weight distribution clearances.

Table 2-4. Minimum Clearances for MG Room Equipment

Equipment	Note	Front mm (in)	Rear mm (in)	Left mm (in)	Right mm (in)	Top mm (in)
10513-725 or 10514-725 frequency converter	2	787.4 (31)	787.4 (31)	152 (6)	762 (30)	-
10513-740 MG set:						
• MG control cabinet	1	762 (30)	-	-	-	-
• Kato MG		762 (30)	305 (12)	457 (18)	457 (18)	406 (16)
10514-740 MG set:						
• MG control cabinet	1	762 (30)	-	-	-	-
• Kato MG		762 (30)	305 (12)	457 (18)	457 (18)	406 (16)
• or Piller MG		762 (30)	305 (12)	457 (18)	457 (18)	406 (16)

Notes:

1. Clearances are not necessary at the rear, left, or right of the MG control cabinet except for power wiring. Holes for power wiring may be made in any of these portions of the control cabinet or power wiring may be routed up through the bottom access opening(s). (See figures giving MG control cabinet dimensions earlier in this chapter.)

2. The clearance at the top of the frequency converter is only that required for maintenance personnel to work safely.

Table 2-5. Minimum MG Weight Distribution Clearances for 340-kg/m² (70-lb/ft²) Floor Loading

Equipment	Front mm (in)	Rear mm (in)	Left mm (in)	Right mm (in)
10513-725 (60-Hz) frequency converter	305 (12)	305 (12)	521 (20.5)	521 (20.5)
10514-725 (50-Hz) frequency converter	356 (14)	356 (14)	610 (24)	610 (24)
10513-740 MG:				
• Control cabinet (Note 1)	—	—	—	—
• Kato, 40 kVA, 60 Hz	597 (23.5)	597 (23.5)	597 (23.5)	597 (23.5)
10514-740 MG:				
• Control cabinet (Note 1)	—	—	—	—
• Kato, 40 kVA, 50 Hz	635 (25)	635 (25)	635 (25)	635 (25)
• or Piller, 40 kVA, 50 Hz	584 (23)	584 (23)	584 (23)	584 (23)

Note:

1. Control cabinet weight distribution clearances beyond those recommended for the service clearances are not necessary.

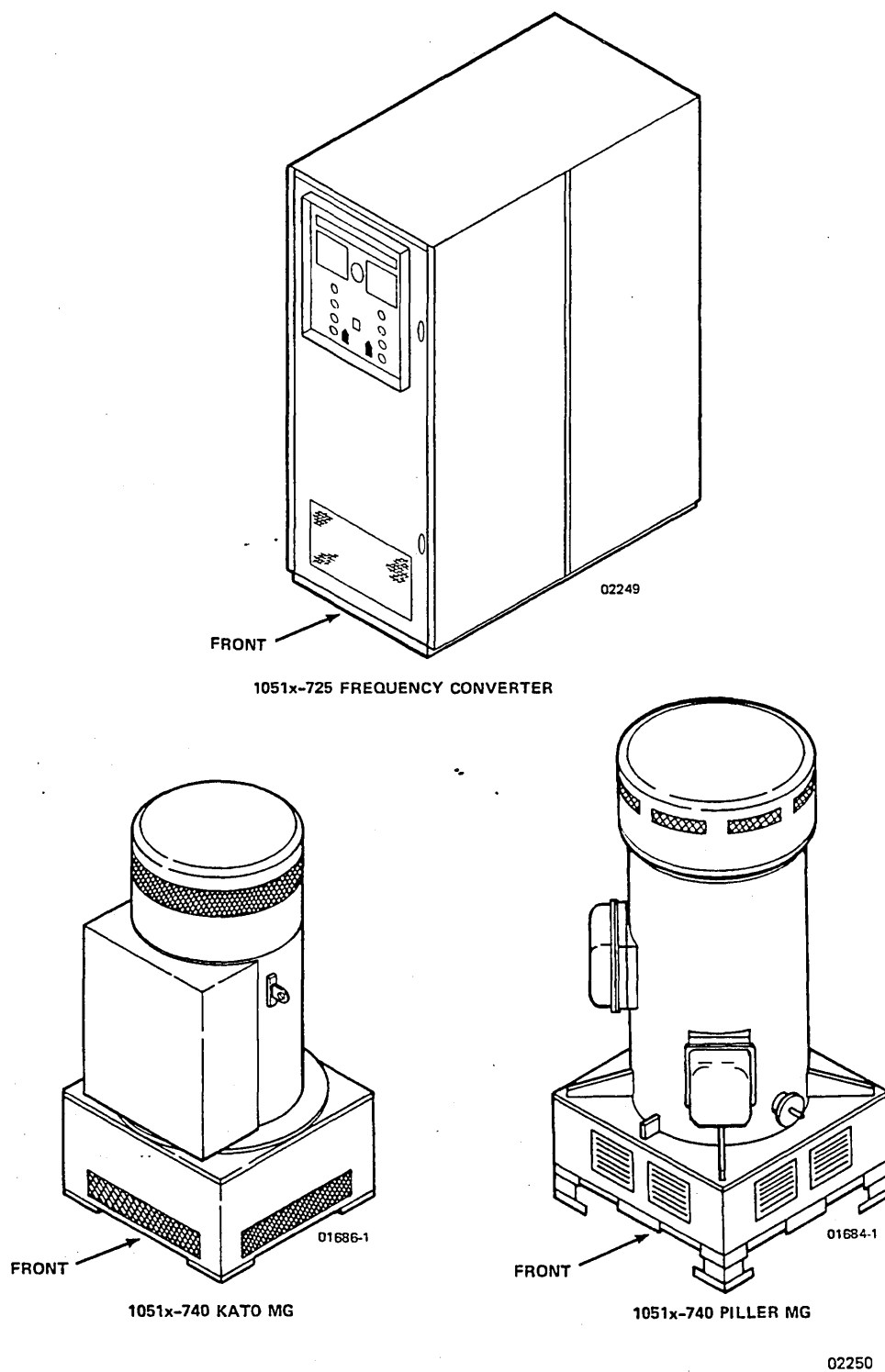
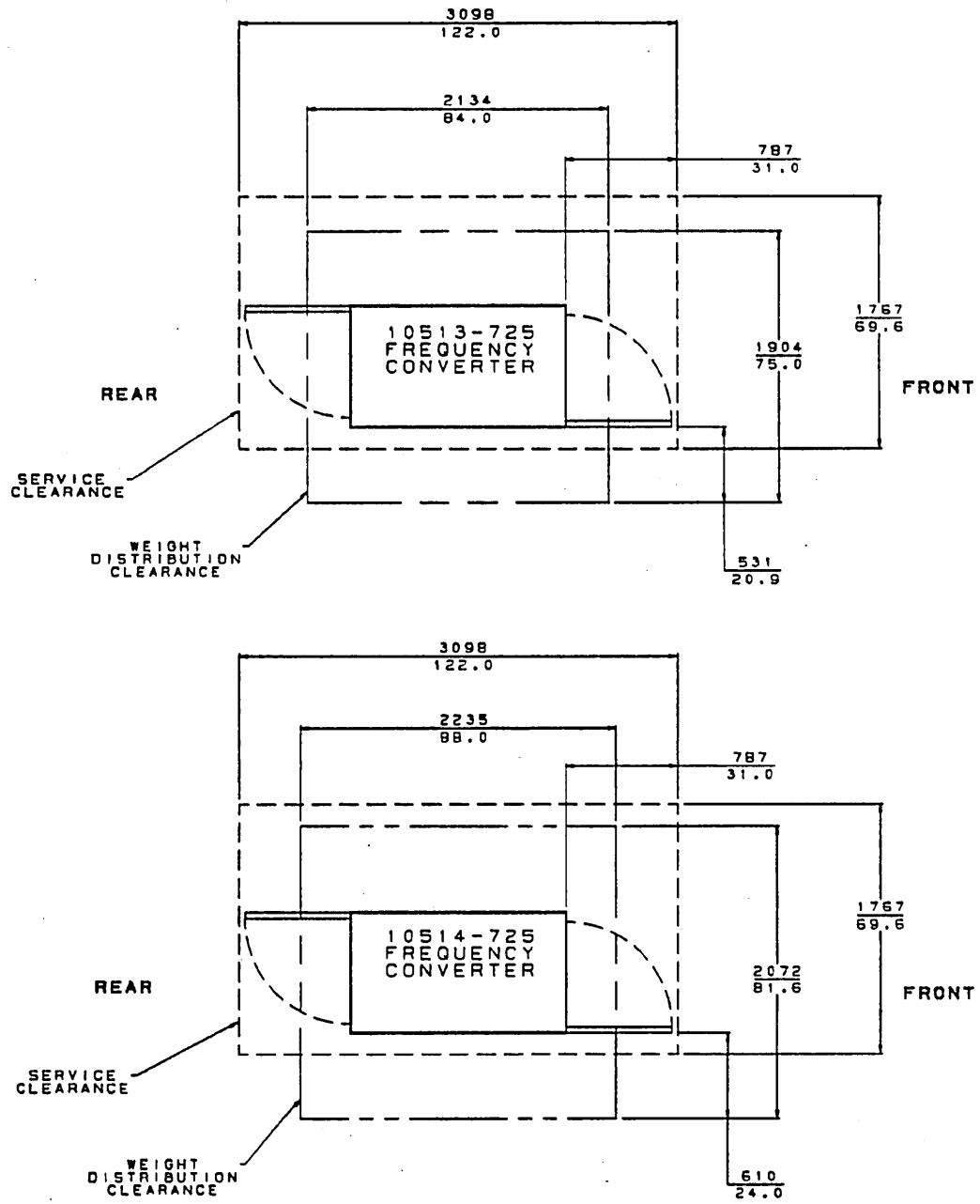


Figure 2-12. Frequency Converter and MG Fronts



60000119-B

Figure 2-13. Clearances for Frequency Converter

What Space Is Required for Equipment in the MG Room?

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What Are Restrictions on Locating Equipment?

Cable lengths and air inlets restrict the distance between the mainframe and other equipment.

Placement of Equipment Based on Cable Lengths

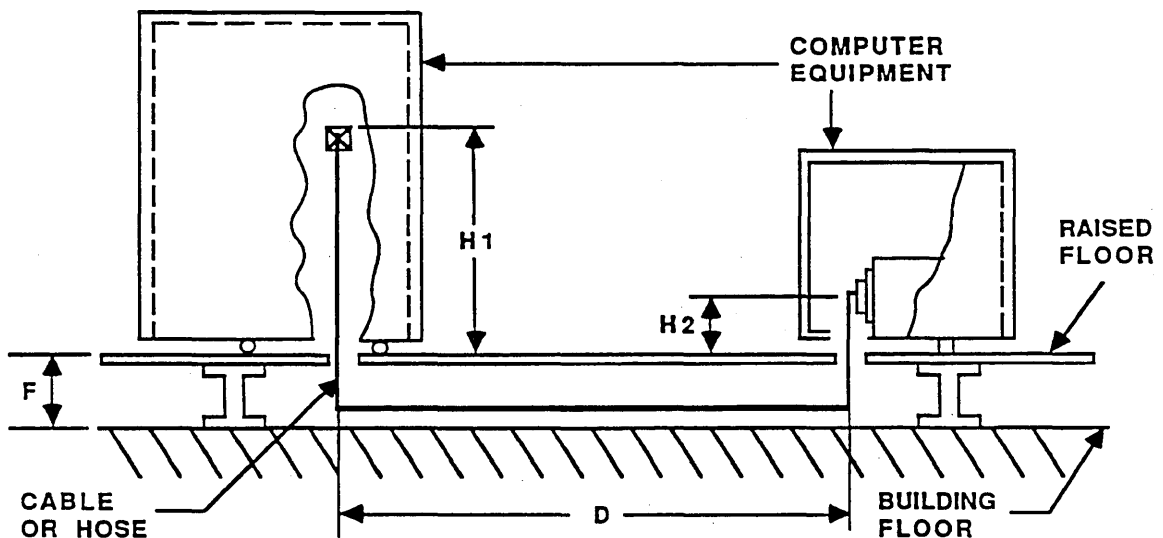
Consider the following distances (figure 2-14) when selecting a location for equipment restricted by the length of a cable:

- L Length of the cable connecting the equipment.
- D Routing distance between the floor cutouts below the equipment, including the distance for routing the cable around obstructions under the raised floor.
- F Height of the raised floor above the building floor. Multiply the height by 2 to account for both ends of the cable.
- H1 and H2 Heights of the cable connectors above the raised floor.
- S Slack in cable (not shown in figure 2-14). Typically, allow 0.6 m (2 ft) of slack.

The sum of these distances must not exceed the length (L) of the cable connecting the equipment.

$$L \geq D + (2 \times F) + H1 + H2 + S$$

The H1 and H2 heights and the L lengths are listed in table 2-6.



M01545

Figure 2-14. Cable Distances Between Equipment

Cable lengths (L) restrict the placements of the equipment listed in table 2-6 and shown in figure 2-15.

Table 2-6. Cable Limitations

From	H1 Height mm (in)	To	H2 Height mm (in)	Qty	Cable Length L m (ft)
CPU (clock and logic cables)	610 (24)	Standalone IOU	1219 (48)	18	14 (45)
CPU (start/stop warning cable)	610 (24)	Standalone IOU expansion	1219 (48)	1	15 (50)
IOU expansion (multiplexer cable)	1219 (48)	Standalone IOU	1219 (48)	1	15 (50)
IOU expansion (start/stop warning cable)	1219 (48)	Standalone IOU	1219 (48)	1	15 (50)
IOU expansion (long warning cable)	914 (36)	Standalone IOU expansion	914 (36)	1	15 (50)
MG interface unit	Note ¹	Power unit	1219 (48)	1	15 (50) Note ²
System console	Note ³	IOU	533 (21)	Note ⁴	Note ⁴
RTA modem	Note ³	System console	Note ³	Note ⁵	Note ⁵
Peripheral equipment Note ⁷	Note ⁶	IOU and optl IOUs	1359 (53.5)	Note ⁶	Note ⁶

1. Depends on customer installation location.

2. Cable is available in 25.4 m (100 ft) length.

3. Depends on height of customer-supplied table.

4. Refer to the system console data in appendix A.

5. Refer to the RTA modem data in appendix B.

6. Depends on equipment installed. Refer to Site Preparation Peripheral Equipment Data or CDCNET Local Area Network Installation manual.

7. Includes Control Data Distributed Communications (CDCNET) and Loosely Coupled Network (LCN).

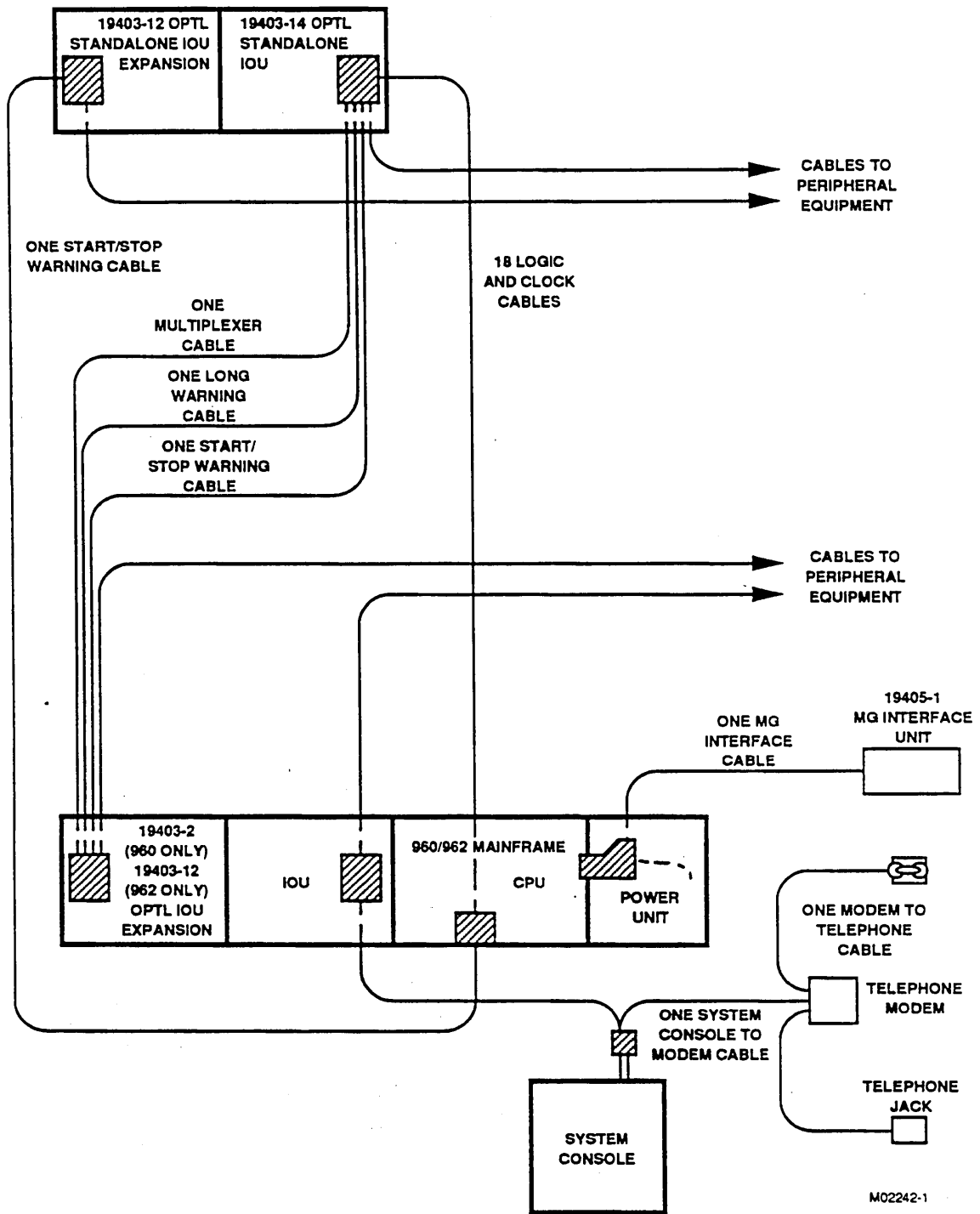


Figure 2-15. Equipment Placement Based on Cabling

Placement of Mainframe Based on Air Inlets

The mainframe and the optional IOUs have air inlets for cooling at the front and rear of the units (figure 2-16). The temperature of the air going into these inlets must not exceed 32°C (90°F). It is critical therefore that the exhaust air from the top of the equipment or from other nearby equipment does not deflect from any surrounding surfaces or have a direct path to any of the air inlets on the sides of the equipment. The location of the mainframe and optional IOUs must ensure the units operate within these requirements.

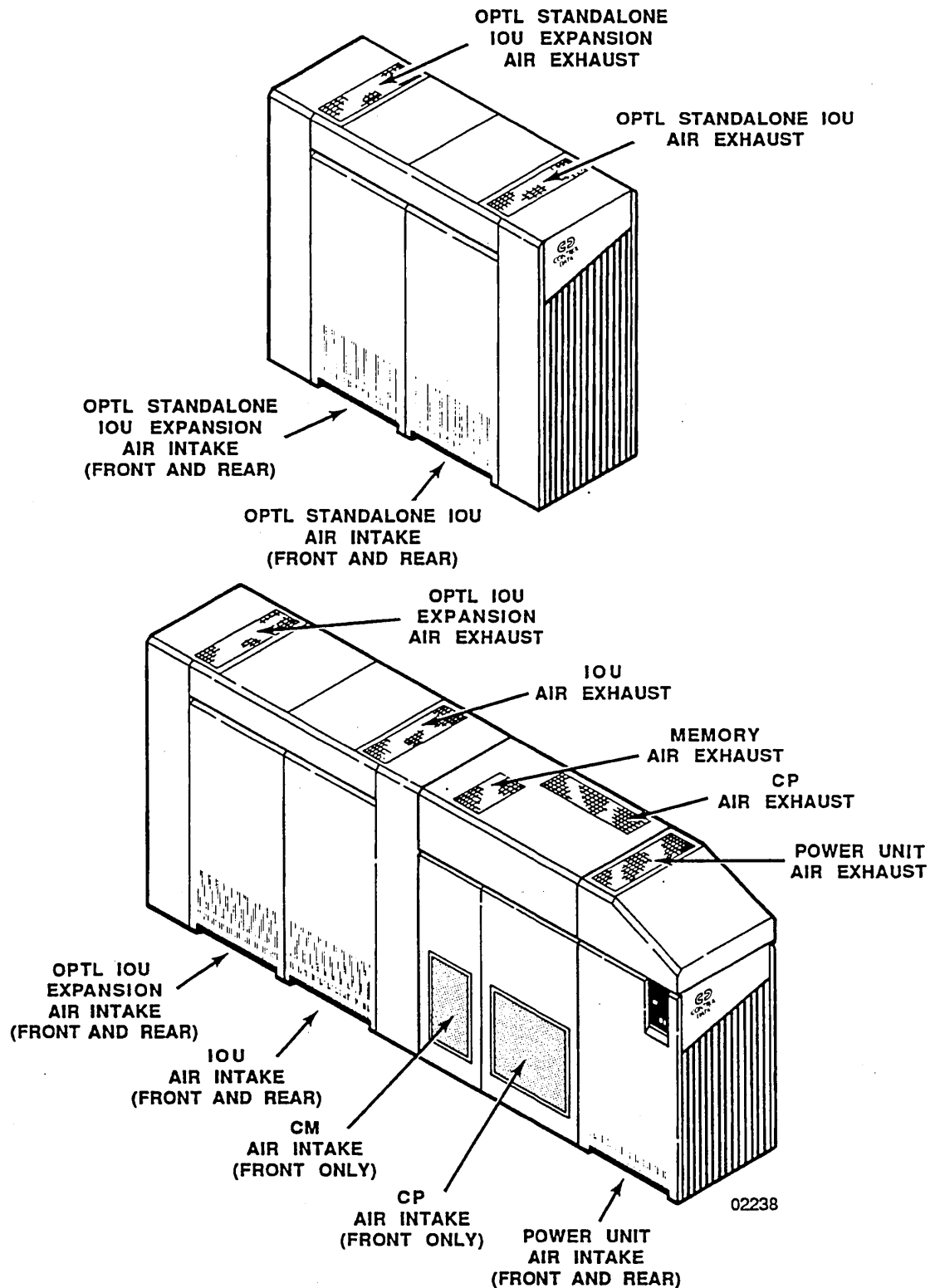


Figure 2-16. Equipment Placement Based on Air Inlet/Outlets

What Floor Cutouts Are Required?

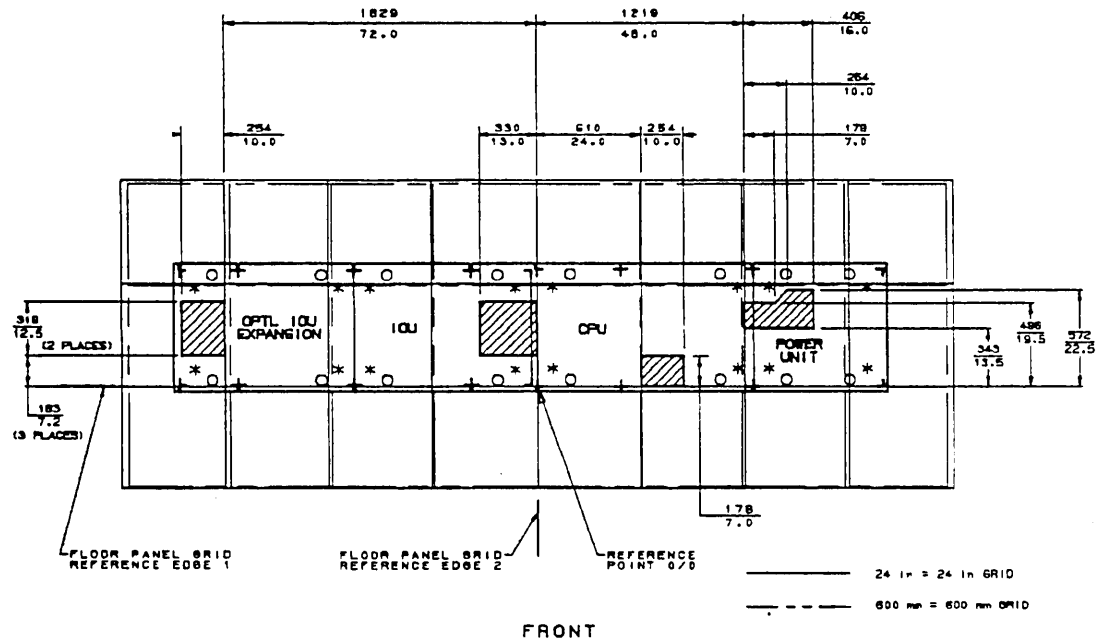
Cutouts in the computer room raised floor are necessary to permit routing of power wires and signal cables under the floor to the equipment. Table 2-7 lists the quantity, size, and purpose of the cutouts. Figure 2-17 shows the size and location of the cutouts. Equipment in the MG room installs directly on the building floor.

Table 2-7. Floor Cutouts

Equipment	Note	Qty	Size mm (in)	Purpose
Power unit		1	See figure 2-17	Power
IOU		1	See figure 2-17	Power, signal
Optl IOU expansion		1	See figure 2-17	Power, signal
Optl standalone IOU		1	See figure 2-17	Power, signal
Optl standalone IOU expansion		1	See figure 2-17	Power, signal
System console and RTA modem	¹	1	64 x 102 mm (2.5 x 4 in)	Power, signal

Note:

1. One cutout can be used for system console and RTA modem.



NOTE:

FLOOR CUTOUT LOCATIONS FOR THE OPTIONAL STANDALONE IOU AND STANDALONE IOU EXPANSION (NOT SHOWN) ARE THE SAME AS FOR THE IOU AND OPTIONAL IOU EXPANSION, AS REFERENCED FROM SIMILAR REFERENCE GRIDS 1 AND 2 THAT ESTABLISH A REFERENCE POINT 0/0 FOR THE STANDALONE UNITS.

60000119-02A

Figure 2-17. Mainframe and Optional IOUs Floor Cutouts

What Space Is Required to Move Equipment to the Site?

The equipment route from the delivery truck to the site computer room and MG room may require moving the equipment through doorways, hallways, stairways, ramps, and elevators. Use the following route planning worksheet to help identify any obstructions on the intended route. Compare the data on the worksheet with the dimensions and weight of the equipment listed in tables 2-9 (van shipment), 2-10 (U.S. and Canada air shipment), 2-11 (international air shipment), or 2-12 (uncrated equipment) to determine if you will need to make any special arrangements for movement of the equipment.

In air shipments, all units ship on pallets. In van shipments, only the 40-kVA MG sets ship on pallets.

Palleted equipment requires the use of material handling devices such as pallet trucks and Rol-a-lifts. Palleted shipments of the mainframe equipment include a 1220-mm (48-in) ramp with the IOU for use in removing all mainframe equipment from the pallets.

The frequency converters and the MG sets (MG and controller) do not have casters. This equipment is designed to be moved with hydraulic lifts (Rol-a-lifts Model M46). The Rol-a-lifts add 914 mm (36 in) to the length of the equipment and 154 kg (340 lb) to the weight. Rol-a-lifts raise and typically add 25 mm (1 in) to the height of the equipment in normal use.

Figure 2-18 shows how to calculate the space required to maneuver the frequency converter or MG set through a 90° turn in a hallway. Use the formula in the figure to calculate the minimum hallway width for moving the frequency converter or MG set through a 90° turn in a hallway. For mainframe complex equipment, the minimum hallway width is listed in a footnote to tables 2-9, 2-10, and 2-11 for the equipment that requires the widest hallway. For peripheral equipment, the minimum hallway width is listed on each data sheet in the Site Preparation Peripheral Equipment Data manual.

CAUTION

To prevent damage to the surface of the floor on route to the site, use floor protection when moving equipment across carpeting or the raised floor. Do not move an MG across a raised floor.

Route Planning Worksheet

Obstruction	Note	Width mm (in)	Depth mm (in)	Height mm (in)	Capacity kg (lb)
Smallest doorway	1	_____	_____	_____	
Smallest hallway		_____	_____	_____	
Smallest stairway or ramp	2	_____	_____	_____	
Elevator door	3	_____	_____	_____	
Elevator box	3	_____	_____	_____	_____

Notes:

1. A route that goes through a doorway and directly onto a ramp requires more than minimum door height. The amount of extra height will vary depending upon the length of the unit being moved, the ramp slope, and the distance of the start of the ramp from the doorway.

2. Control Data equipment designs permit equipment movement over ramps with a maximum slope of 15°.

3. Be sure to consider the space taken by elevator railings and doors (figure 2-19). If railings are not removable, measure to railing not to wall.

What Space Is Required to Move Equipment to the Site?

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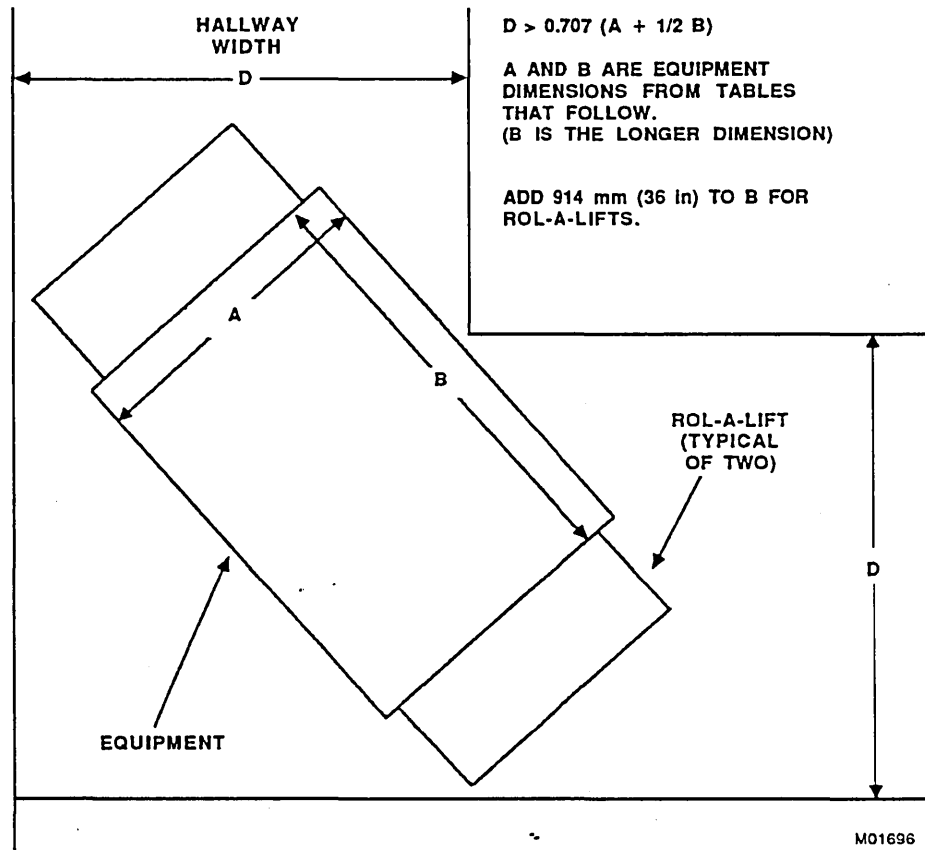


Figure 2-18. Hallway With 90° Turn

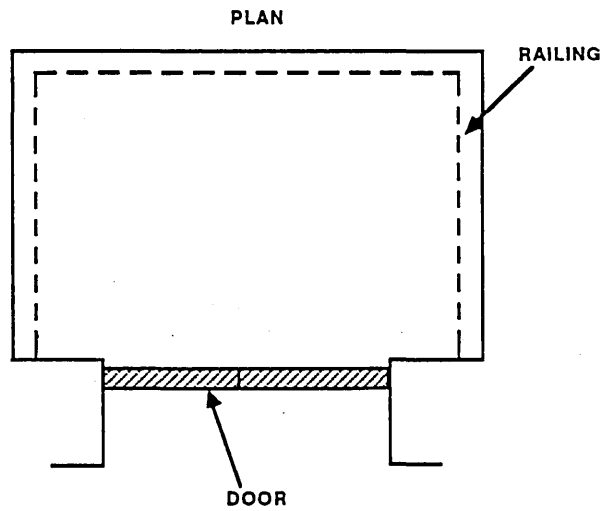


Figure 2-19. Elevator

Table 2-8. Van Shipment Dimensions and Weight

Equipment	Note	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
Mainframe:					
• Power unit	2	1050 (41)	820 (32)	1960 (77)	660 (1450)
• CPU	1,2	1350 (53)	820 (32)	1960 (77)	765 (1675)
• IOU	1,2	1120 (44)	820 (32)	1960 (77)	535 (1175)
Optl IOU expansion	1,2	1120 (44)	820 (32)	1960 (77)	540 (1185)
Optl standalone IOU	1,2	1120 (44)	820 (32)	1960 (77)	540 (1185)
Optl standalone IOU expansion	1,2	1120 (44)	820 (32)	1960 (77)	540 (1185)
19405-1 MG interface unit		546 (21.5)	673 (26.5)	406 (16)	25 (55)
10513-725 frequency converter 25 kVA, 60 Hz	3,4	1660 (65)	920 (36)	1680 (66)	1360 (2990)
10514-725 frequency converter 25 kVA, 50 Hz	3,4	1660 (65)	840 (33)	1310 (51.6)	1410 (3100)
10513-740 MG set, 40 kVA, 60 Hz:					
• MG control cabinet	3	889 (35)	610 (24)	1880 (74)	286 (630)
• and Kato MG	3	991 (39)	737 (29)	1778 (70)	1184 (2610)
10514-740 MG set, 40 kVA, 50 Hz:					
• MG control cabinet	3	840 (33)	610 (24)	1880 (74)	286 (630)
• and Kato MG	3	991 (39)	737 (29)	1778 (70)	1417 (3124)
• or Piller MG	3	900 (35.4)	900 (35.4)	1500 (59.1)	1500 (3305)

(Continued)

Table 2-8. Van Shipment Dimensions and Weight (Continued)

Equipment	Note	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
System console	5	-	-	-	-
RTA modem	6	-	-	-	-

Notes:

1. Weight includes options.
2. Unit shipped without pallet.
3. Unit shipped with pallet.
4. Largest equipment. To make a 90° turn around a hallway corner with Rol-a-lifts, this equipment requires a minimum hallway width of 1625 mm (64 in).
5. Refer to system console data in appendix A.
6. Customer engineer brings RTA modem to site.

Table 2-9. U.S. and Canada Air Shipment Dimensions and Weight

Equipment	Note	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
Mainframe:					
• Power unit	2	1100 (43)	902 (35.5)	2090 (82)	715 (1575)
• CPU	1,2	1450 (57)	902 (35.5)	2090 (82)	815 (1785)
• IOU	2,3	1200 (47)	902 (35.5)	2090 (82)	580 (1275)
Optl IOU expansion	1,2	1200 (47)	902 (35.5)	2090 (82)	585 (1285)
Optl standalone IOU	2	1200 (47)	902 (35.5)	2090 (82)	585 (1285)
Optl standalone IOU with optl standalone expansion	1,2	1200 (47)	902 (35.5)	2090 (82)	585 (1285)
19405-1 MG interface unit		546 (21.5)	673 (26.5)	406 (16)	25 (55)
10513-725 frequency converter 25 kVA, 60 Hz	2,4	1660 (65)	970 (38)	1810 (71)	1410 (3100)
10514-725 frequency converter 25 kVA, 50 Hz	2,4	1660 (65)	970 (38)	1810 (71)	1410 (3100)
10513-740 MG set, 40 kVA, 60 Hz:					
• MG control cabinet	2	889 (35)	610 (24)	1994 (78.5)	306 (675)
• and Kato MG	2	991 (39)	737 (29)	1778 (70)	1184 (2610)
10514-740 MG set, 40 kVA, 50 Hz:					
• MG control cabinet	2	899 (35)	610 (24)	1994 (78.5)	306 (675)
• and Kato MG	2	991 (39)	737 (29)	1778 (70)	1417 (3124)
• or Piller MG	2	900 (35.4)	900 (35.4)	1500 (59.1)	1500 (3305)

(Continued)

Table 2-9. U.S. and Canada Air Shipment Dimensions and Weight (Continued)

Equipment	Note	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
System console	5	—	—	—	—
RTA Modem	6	—	—	—	—

Notes:

1. Weight includes options.
2. Unit shipped with pallet.
3. Shipped with a ramp that is for use in removing all mainframe units from pallets.
4. Largest equipment. To make a 90° turn around a hallway corner with Rol-a-lifts, this equipment requires a minimum hallway width of 1650 mm (65 in).
5. Refer to system console data in appendix A.
6. Customer engineer brings RTA modem to site.

Table 2-10. International Air Shipment Dimensions and Weight

Equipment	Note	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
Mainframe:					
• Power unit	2	940 (37)	902 (35.5)	2090 (82)	690 (1510)
• CPU	1,2	1450 (57)	902 (35.5)	2090 (82)	815 (1785)
• IOU	2,3	1200 (47)	902 (35.5)	2090 (82)	580 (1275)
Optl IOU expansion	1,2	1200 (47)	902 (35.5)	2090 (82)	585 (1285)
Optl standalone IOU	2	1200 (47)	902 (35.5)	2090 (82)	580 (1275)
Optl standalone IOU expansion	1,2	1200 (47)	902 (35.5)	2090 (82)	585 (1285)
19405-1 MG interface unit		546 (21.5)	673 (26.5)	406 (16)	25 (55)
10513-725 frequency converter 25 kVA, 60 Hz	2,4	1660 (65)	970 (38)	1810 (71)	1410 (3100)
10514-725 frequency converter 25 kVA, 50 Hz	2,4	1660 (65)	970 (38)	1810 (71)	1410 (3100)
10513-740 MG set, 40 kVA, 60 Hz:					
• MG control cabinet	2	889 (35)	610 (24)	1994 (78.5)	306 (675)
• and Kato MG	2	991 (39)	737 (29)	1778 (70)	1184 (2610)
10514-740 MG set, 40 kVA, 50 Hz:					
• MG control cabinet	2	889 (35)	610 (24)	1994 (78.5)	306 (675)
• and Kato MG	2	991 (39)	737 (29)	1778 (70)	1417 (3124)
• or Piller MG	2	900 (35.4)	900 (35.4)	1500 (59.1)	1500 (3305)

(Continued)

Table 2-10. International Air Shipment Dimensions and Weight (Continued)

Equipment	Note	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
System console	5	-	-	-	-
RTA modem	6	-	-	-	-

Notes:

1. Weight includes options.
2. Unit shipped with pallet.
3. Shipped with a ramp that is for use in removing all mainframe units from pallets.
4. Largest equipment. To make a 90° turn around a hallway corner with Rol-a-lifts, this equipment requires a minimum hallway width of 1650 mm (65 in).
5. Refer to system console data in appendix A.
6. Customer engineer brings RTA modem to site.

Table 2-11. Uncrated Dimensions and Weight

Equipment	Note	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
Mainframe:					
• Power unit	2	800 (31.5)	762 (30)	1930 (76)	625 (1375)
• CPU	1,2	1283 (50.5)	762 (30)	1930 (76)	760 (1665)
• IOU	2	1034 (40.7)	762 (30)	1930 (76)	453.6 (1000)
Optl IOU expansion	1,2	1034 (40.7)	762 (30)	1930 (76)	453.6 (1000)
Optl standalone IOU	2	1034 (40.7)	762 (30)	1930 (76)	453.6 (1000)
Optl standalone IOU expansion	1,2	1034 (40.7)	762 (30)	1930 (76)	453.6 (1000)
19405-1 MG interface unit		178 (7.0)	546 (21.5)	362 (14.2)	18 (40)
10513-725 frequency converter 25 kVA, 60 Hz	3,4	1608 (63.2)	864 (34)	1677 (66)	1360 (2985)
10514-725 frequency converter 25 kVA, 50 Hz	3,4	1608 (63.2)	864 (34)	1677 (66)	1360 (2985)
10513-740 MG set, 40 kVA, 60 Hz:					
• MG control cabinet	3	813 (32)	584 (23)	1880 (74)	284 (625)
• and Kato MG	3	711 28.0	711 28.0	1445 (56.9)	1205 (2650)
10514-740 MG set, 40 kVA, 50 Hz:					
• MG control cabinet	3	813 (32)	584 (23)	1880 (74)	284 (625)
• and Kato MG	3	711 (28.0)	711 (28.0)	1524 (60)	1338 (2950)
• or Piller MG	3	820 (32.3)	820 (32.3)	1435 (56.5)	1435 (3160)

(Continued)

Table 2-11. Uncrated Dimensions and Weight (Continued)

Equipment	Note	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
System console	5	—	—	—	—
RTA modem	6	—	—	—	—

Notes:

1. Weight include options.
2. Unit with casters.
3. Unit without casters.
4. Largest equipment. To make a 90° turn around a hallway corner with Rol-a-lifts, this equipment requires a minimum hallway width of 1575 mm (62 in).
5. Refer to system console data in appendix A.
6. Customer engineer brings RTA modem to site.

Environmental Requirements

3

What Operating Temperature and Humidity Ranges Are Required?	3-2
How is Temperature Monitored?	3-3
What Nonoperating Temperature and Humidity Ranges Are Required?	3-4
What are the Air Outlet Airflows and Velocities?	3-5
How Much Heat Does the Equipment Output to Air in the Computer Room?	3-8
How Much Heat Does the Equipment Output to Air in the MG Room?	3-12
How Much Noise Does the Equipment Emit?	3-16

Environmental Requirements

3

This chapter contains environmental specifications of the mainframe complex equipment, air conditioning worksheets, and equipment noise emissions.

Chapter 2 of the Site Preparation Peripheral Equipment Data manual contains environmental specifications of the peripheral equipment.

Chapter 3 of the Site Preparation General Information manual contains information on air conditioning, lighting, and acoustics.

Use the information in these manuals to plan the site air conditioning system and acoustical treatment of the computer room.

What Operating Temperature and Humidity Ranges Are Required?

Equipment operating in the computer room and the MG room requires controlled ranges of temperature and humidity (table 3-1) to ensure proper operation.

CAUTION

Overheating of the equipment can cause intermittent or long-term reliability problems. Overheating will occur if the temperature of air going into the mainframe air inlets exceeds 32°C (90°F). The maximum air-inlet temperature decreases 1°C (1.8°F) for each 500 m (1641 ft) of altitude.

Table 3-1. Operating Conditions

Equipment	Note	Temperature Range	Relative Humidity Range	Maximum Dew Point
Mainframe	1	15°C to 32°C (60°F to 90°F)	20% to 80%	24°C (75°F)
19403-2, 19403-12, or 19403-14 optl IOU	1	15°C to 32°C (59°F to 90°F)	20% to 80%	24°C (75°F)
19405-1 MG interface unit	1,2	15°C to 32°C (60°F to 90°F)	10% to 90%	—
10513-725/10514-725 frequency converter	1,2	0°C to 40°C (32°F to 104°F)	10% to 90%	—
10513-740/ 10514-740 MG set	1,2	0°C to 40°C (32°F to 104°F)	10% to 90%	—
System console	3	—	—	—
RTA modem	4	—	—	—

Notes:

1. Noncondensing.
2. No dew-point requirement.
3. Refer to system console data in appendix A.
4. Refer to RTA modem data in appendix B.

How is Temperature Monitored?

Internal CPU sensors monitor the computer room temperature. If the temperature reaches a preset warning limit, a warning message is displayed on the system console. If the mainframe reaches a shutdown limit, the temperature control circuits remove power from the mainframe. Table 3-2 lists the warning and shutdown limits.

Table 3-2. Warning and Shutdown Limits

Condition	Warning Limit	Shutdown Limit
Room temperature	Over 31°C (89°F)	Over 34°C (93°F)

What Nonoperating Temperature and Humidity Ranges Are Required?

Table 3-3 lists the equipment required nonoperating conditions.

When the equipment moves from a nonoperating to an operating environment, the equipment requires controlled ranges of temperature and humidity to prevent physical or operating problems.

Table 3-3. Nonoperating Conditions

Equipment	Note	Temperature Range	Relative Humidity Range
Mainframe		5°C to 50°C (40°F to 122°F)	5% to 95%
19403-2, 19403-12, or 19403-14 optl IOU		5°C to 50°C (40°F to 122°F)	5% to 95%
19405-1 MG interface unit		-35°C to 66°C (-30°F to 150°F)	5% to 95%
10513-725/10514-725 frequency converter		-54°C to 52°C (-65°F to 125°F)	10% to 90%
10513-740/ 10514-740 MG set		-54°C to 52°C (-65°F to 125°F)	10% to 90%
System console	1	-	-
RTA modem	2	-	-

Notes:

1. Refer to system console data in appendix A.
2. Refer to RTA modem data in appendix B.

What are the Air Outlet Airflows and Velocities?

To help your planning, table 3-4 provides the airflow and air velocities from the equipment air outlets.

Table 3-4. Air Outlet Airflow and Velocities

Equipment	Airflow 50 Hz	Airflow 60 Hz	Velocity 50 Hz	Velocity 60 Hz
Power unit	283 L/s (600 ft ³ /min)	326 L/s (690 ft ³ /min)	624 m/min (2047 ft/min)	718 m/min (2355 ft/min)
CP	1015 L/s (2150 ft ³ /min)	1133 L/s (2400 ft ³ /min)	479 m/min (1570 ft/min)	533 m/min (1750 ft/min)
Memory	260 L/s (550 ft ³ /min)	293 L/s (620 ft ³ /min)	531 m/min (1742 ft/min)	594 m/min (1950 ft/min)
IOU	342 L/s (725 ft ³ /min)	389 L/s (825 ft ³ /min)	257 m/min (843 ft/min)	293 m/min (961 ft/min)
Optl IOU expansion	349 L/s (740 ft ³ /min)	396 L/s (840 ft ³ /min)	263 m/min (862 ft/min)	298 m/min (978 ft/min)
Optl standalone IOU	342 L/s (725 ft ³ /min)	389 L/s (825 ft ³ /min)	257 m/min (843 ft/min)	293 m/min (961 ft/min)
Optl standalone IOU expansion	349 L/s (740 ft ³ /min)	396 L/s (840 ft ³ /min)	263 m/min (862 ft/min)	298 m/min (978 ft/min)

What are the Air Outlet Airflows and Velocities?

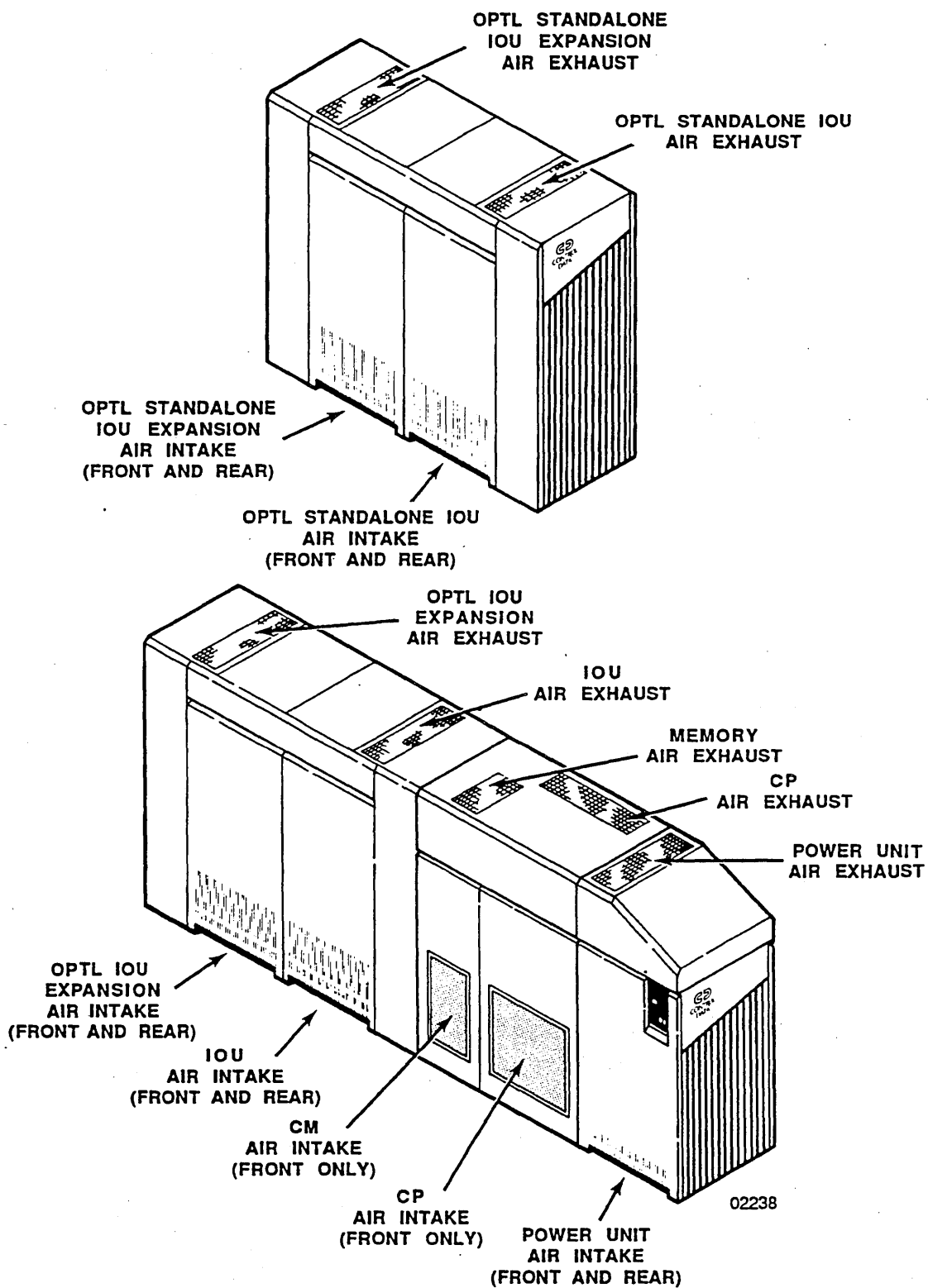


Figure 3-1. Equipment Air Inlet/Outlets

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How Much Heat Does the Equipment Output to Air in the Computer Room?

The typical total heat outputs to air from the equipment, operating with either 50-Hz and 400-Hz or 60-Hz and 400-Hz power, are listed in table 3-4. Use the following air conditioning worksheet to help you determine the air conditioning requirements for the computer room. Consider future requirements when you plan the air conditioning system. The heat output of the mainframe complex is entirely to air. It is important to recognize this when defining your air conditioning requirements, particularly if the mainframe complex replaces equipment that uses both air and water.

Table 3-5. Heat Output to Air in Computer Room

Equipment	Note	Typical Heat Output	Typical Heat Output
		kW (Btu/h) 50 Hz/400 Hz	kW (Btu/h) 60 Hz/400 Hz
Power unit and CPU with CP-0 and memory increments	1	10.6 (36 200)	11.0 (37 600)
CP-1	1	5.4 (18 400)	5.4 (18 400)
19403-1 960 IOU	1	7.7 (26 300)	7.7 (26 300)
19403-2 960 IOU exp with options	1	5.2 (17 700)	5.2 (17 700)
19403-11 962 IOU	1	6.8 (23 200)	6.8 (23 200)
19403-12 962 IOU exp with options	1	6.5 (22 200)	6.5 (22 200)
19403-14 Optl standalone IOU	1	6.8 (23 200)	6.8 (23 200)
19403-12 Optl standalone IOU exp with options	1	6.5 (22 200)	6.5 (22 200)
19405-1 MG interface unit	2	—	—
10513-725/10514-725 frequency converter	3	—	—
System console	4	—	—
RTA modem	5	—	—

Notes:

- Heat outputs of 0.1 kW (340 Btu/h) or greater are rounded to the nearest 0.1 kW and 100 Btu/h. Heat outputs less than 0.1 kW (340 Btu/h) are rounded to the nearest 0.01 kW and 10 Btu/h.
- Heat output is negligible.
- Refer to How Much Heat Does the Equipment Output to Air in the MG Room? discussed later in this chapter.
- Refer to system console data in appendix A.
- Refer to RTA modem data in appendix B.

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Note:

1. Refer to Site Preparation Peripheral Equipment Data manual for heat output.

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How Much Heat Does the Equipment Output to Air in the MG Room?

The no-load and full-load heat outputs to air and the airflow from the equipment in the MG room are listed in table 3-5. Use the following air conditioning worksheet to help you determine the air conditioning requirements for the MG room. Consider future requirements when you plan the air conditioning system.

Table 3-6. Heat Output to Air in MG Room

Equipment	Note	No-Load Heat Output kW (Btu/h)	Full-Load Heat Output kW (Btu/h)	Airflow m ³ /min (ft ³ /min)
10514-725 frequency converter	1,2	4.7 (16 000)	8.4 (28 500)	21.24 (750)
10513-725 frequency converter	1,2	4.1 (14 000)	8.4 (28 500)	21.24 (750)
10513-740 MG set:				
• MG control cabinet	1	0.3 (900)	0.8 (2700)	None
• and Kato MG	1	6.3 (21 500)	9.4 (32 000)	39.6 (1400)
10514-740 MG set:				
• MG control cabinet	1	0.3 (900)	0.8 (2700)	None
• and Kato MG	1	4.9 (16 700)	9.4 (32 000)	39.6 (1400)
• or Piller MG	1	6.7 (21 400)	14.7 (50 200)	68.0 (2400)

Notes:

1. Heat outputs are rounded to the nearest 0.1 kW and 100 Btu/h.
2. This data applies to the computer room if the frequency converter is to be installed there rather than in the MG room.

Use the following formula to calculate the approximate heat output for MG equipment operating at less than full load:

$$\text{HEAT OUTPUT} = [\text{LOAD FRACTION} \times (\text{FULL-LOAD HEAT OUTPUT} - \text{NO-LOAD HEAT OUTPUT})] + \text{NO-LOAD HEAT OUTPUT}$$

where

LOAD FRACTION is from the 400-Hz power worksheet in chapter 4 and
FULL-LOAD HEAT OUTPUT and NO-LOAD HEAT OUTPUT are from table 3-5.

For example, the heat output of an MG with 0.8 load fraction is:

$$\text{HEAT OUTPUT} = [0.8 (2700 - 900)] + 900$$

$$\text{HEAT OUTPUT} = 0.8 (1800) + 900$$

$$\text{HEAT OUTPUT} = 1440 + 900$$

$$\text{HEAT OUTPUT} = 2340 \text{ Btu/h}$$

Table 3-7. Air Conditioning Worksheet for Your MG Room

Equipment	Load	Heat Output
Frequency Converter	_____	_____
Frequency Converter	_____	_____
MG	_____	_____
MG control cabinet	_____	_____
MG	_____	_____
MG control cabinet	_____	_____
Total	_____	_____

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How Much Noise Does the Equipment Emit?

The noise power emission level, the acoustical power that the equipment generates, is independent of measurement distance and acoustical characteristics of the room.

Table 3-8. Noise Emission (ECMA Standard 109)

Equipment	Note	Operating Noise Emission Level bel 50 Hz	Operating Noise Emission Level bel 60 Hz
960/962 mainframe with optl CP-1 and memory increments		7.8	8.1
960 mainframe with optl IOU expansion and options		7.9	8.1
962 mainframe with optl IOU expansion and options		8.1	8.2
19403-14 optl standalone IOU		7.0	7.0
19403-12 optl standalone IOU expansion and options		7.0	7.0
19405-1 MG interface unit		None	None
System console	1		
RTA modem	2		

Notes:

1. Refer to system console data in appendix A.
2. Refer to RTA modem data in appendix B.

The noise emitted from the equipment to be located in a computer room is listed in table 3-7. These noise emissions are measured according to ANSI Standard S12.10 and are reported according to ECMA Standard 109.

Power Requirements

4

What 50/60-Hz Input Voltage Is Required for the Equipment?	4-1
How Much 50/60-Hz Power Does the Equipment in the Computer Room Consume? .	4-4
How Much 50/60-Hz Power Does the Equipment in the MG Room Consume?	4-7
What 400-Hz Input Voltage is Required for the Equipment?	4-11
How Much 400-Hz Power Does the Equipment Consume?	4-14
How is Power Connected to Equipment in the Computer Room?	4-17
Where are Entry Power Locations for Direct Wiring?	4-23
How is Power Connected to Equipment in the MG Room?	4-27
Frequency Converter Connections	4-27
MG Set Connections	4-30
How to Wire Power and Control to the MG Interface Unit	4-34
What Power Items Must You Supply?	4-37

This chapter contains electrical specifications of the mainframe complex equipment, 50/60- and 400-Hz power worksheets, and lists of power and control items that you must supply.

Chapter 2 of the Site Preparation Peripheral Equipment Data manual contains electrical specifications of the peripheral equipment.

Chapter 4 of the Site Preparation General Information manual contains information on power requirements, power distribution, power connections, convenience outlets, MG sets, phase rotation, grounding, and lightning protection.

Use the information in these manuals to plan the site power distribution system.

What 50/60-Hz Input Voltage Is Required for the Equipment?

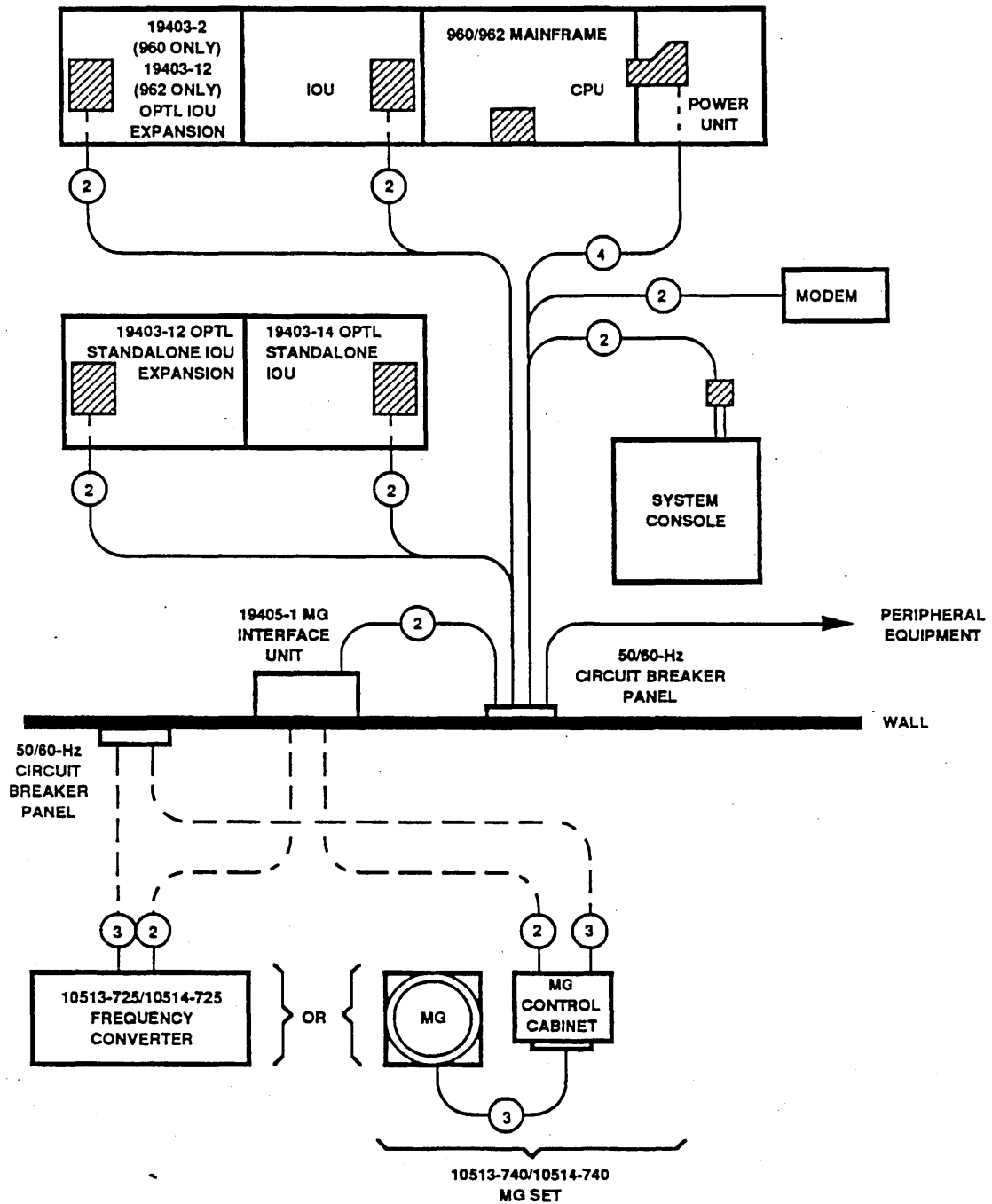
Some equipment in the computer room and MG room requires 50- or 60-Hz input voltage. Table 4-1 lists the required voltages and figure 4-1 shows the 50/60-Hz wiring diagrams for the frequency converter and MG set.

Table 4-1. 50/60-Hz Input Voltages

Equipment	Note	50-Hz Voltage	60-Hz Voltage	Phase
Mainframe:				
• Power unit		220/380 or 240/415	120/208	3
• CPU		N/A	N/A	N/A
• IOU		220/240	120	1
19403-2/19403-12 optl IOU expansion		220/240	120	1
19403-14 optl standalone IOU		220/240	120	1
19403-12 optl standalone IOU expansion		220/240	120	1
19405-1 MG interface unit		220/240	120	1
10513-725 frequency converter	1	N/A	208, 220, 440, or 460	3
10514-725 frequency converter	1	380, 400, or 415	N/A	3
10513-740 MG set		N/A	208, 440, 460, or 480	3
10514-740 MG set		220, 230, 240, 380, 400, 415	N/A	3
System console	2,3	-	-	-
RTA modem	4	-	-	-

Notes:

1. This data applies to the computer room if the frequency converter is to be installed there rather than in the MG room.
2. Refer to system console data in appendix A.
3. Contains a switching power supply. Refer to Special Power Distribution in chapter 4 of the Site Preparation General Information manual.
4. Refer to RTA modem data in appendix B.



NOTES:

1. AN ENERGIZED 50/60-Hz CIRCUIT BREAKER PANEL MUST PROVIDE POWER TO THE POWER UNIT AND MG INTERFACE UNIT FOR THE POWER UNIT TO CONTROL THE MG SET.
2. THE 50/60-Hz CIRCUIT BREAKER PANEL FOR THE MG SET MUST BE VISIBLE FROM THE MG SET CONTROLLER CABINET OR FROM THE FREQUENCY CONVERTER.

—○— SYMBOL INDICATES NUMBER OF CONDUCTORS IN RUN (NOT INCLUDING SAFETY GROUND).

M02243-1

Figure 4-1. 50/60-Hz Wiring Diagram for Mainframe Complex

How Much 50/60-Hz Power Does the Equipment in the Computer Room Consume?

The 50- or 60-Hz power that the equipment in the computer room consumes is listed in table 4-2. Use the power worksheet on a following page to help you determine the 50/60-Hz power requirements for the computer room. Consider future requirements when you plan the site power distribution system.

Table 4-2. 50/60-Hz Power Consumption in Computer Room

Equipment	Note	Typical 50-Hz Power Consumption kVA	Typical 60-Hz Power Consumption kVA
Power unit and CPU with optl CP-1 and memory increments		2.8	3.2
IOU		0.5	0.5
19403-2 IOU expansion with options		0.5	0.5
19403-12 IOU expansion with options		0.5	0.5
19403-14 optl standalone IOU		0.5	0.5
19403-12 optl standalone IOU expansion with options		0.5	0.5
19405-1 MG interface unit	1	—	—
10513-725/10514-725 frequency converter	2	—	—
System console	3	—	—
RTA modem	4	—	—

Notes:

1. Power consumption is negligible.
2. Refer to How Much 50/60-Hz Power Does the Equipment in the MG Room Consume? discussed later in this chapter.
3. Refer to the system console data in appendix A.
4. Refer to RTA modem data in appendix B.

50/60-Hz Power Worksheet for Your Computer Room

Equipment	Power Consumption Each	Qty	Power Consumption Total
Power unit and CPU with optl CP-1 and memory increments			_____
IOU			_____
19403-2 (960) or 19403-12 (962) IOU expansion with options			_____
19403-14 optl standalone IOU			_____
19403-12 optl standalone IOU expansion with options			_____
19405-1 MG interface unit			_____
System console			_____
RTA modem			_____
Peripheral equipment (Note ¹)			
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
Total	_____	_____	_____

Note:

1. Refer to Site Preparation Peripheral Equipment Data manual for power consumption.

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How Much 50/60-Hz Power Does the Equipment in the MG Room Consume?

The 50/60-Hz power that the equipment in the MG room consumes during full-load operation and the current that the equipment draws during the starting sequence are listed in table 4-3. Use the power worksheet on a following page to help you determine the 50/60-Hz power requirements for the MG room. Consider future requirements when you plan the site power distribution system.

Table 4-3. 50/60-Hz Power Consumption in MG Room

Equipment	Full-Load Power Consump- tion kVA	Starting Current Amps per Phase (Note ²)	MG Motor Rating hp	Starting Current Amps per Phase (Note ³)
10513-725 frequency converter (Note ¹)	41.1	@208 to 220 V = 1080 A @440 to 460 V = 540 A	40	@208 to 220 V = 193 A @440 to 460 V = 100 A
10514-725 frequency converter (Note ¹)	41.4	@380 to 415 V = 600 A	40	@380 to 415 V = 110 A
10513-740 MG set with Kato MG	59	@208 V = 1450 A @220 V = 1540 A @440 V = 770 A @460 V = 805 A @480 V = 840 A	60	@208 V = 213 A @220 V = 225 A @440 V = 113 A @460 V = 118 A @480 V = 123 A
10514-740 MG set with Kato MG	59	@220 V = 1435 A @230 V = 1500 A @240 V = 1565 A @380 V = 812 A @400 V = 850 A @415 V = 886 A	60	@220 V = 205 A @230 V = 215 A @240 V = 224 A @380 V = 119 A @400 V = 125 A @415 V = 130 A
10514-740 MG set with Piller MG	67	@220 V = 1625 A @230 V = 1700 A @240 V = 1775 A @380 V = 925 A @400 V = 970 A @415 V = 1015 A	60	@220 V = 205 A @230 V = 215 A @240 V = 224 A @380 V = 119 A @400 V = 125 A @415 V = 130 A

Notes:

1. This data applies to the computer room if the frequency converter installation is there rather than in the MG room.
2. First-cycle peak of three-cycle asymmetrical surge current drawn by MG equipment.
3. Starting current required for 1 minute after three-cycle asymmetrical surge.

50/60-Hz Power Worksheet for Your MG Room

Equipment	Power Consumption
Frequency converter	_____
MG set	_____
Total	_____

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What 400-Hz Input Voltage is Required for the Equipment?

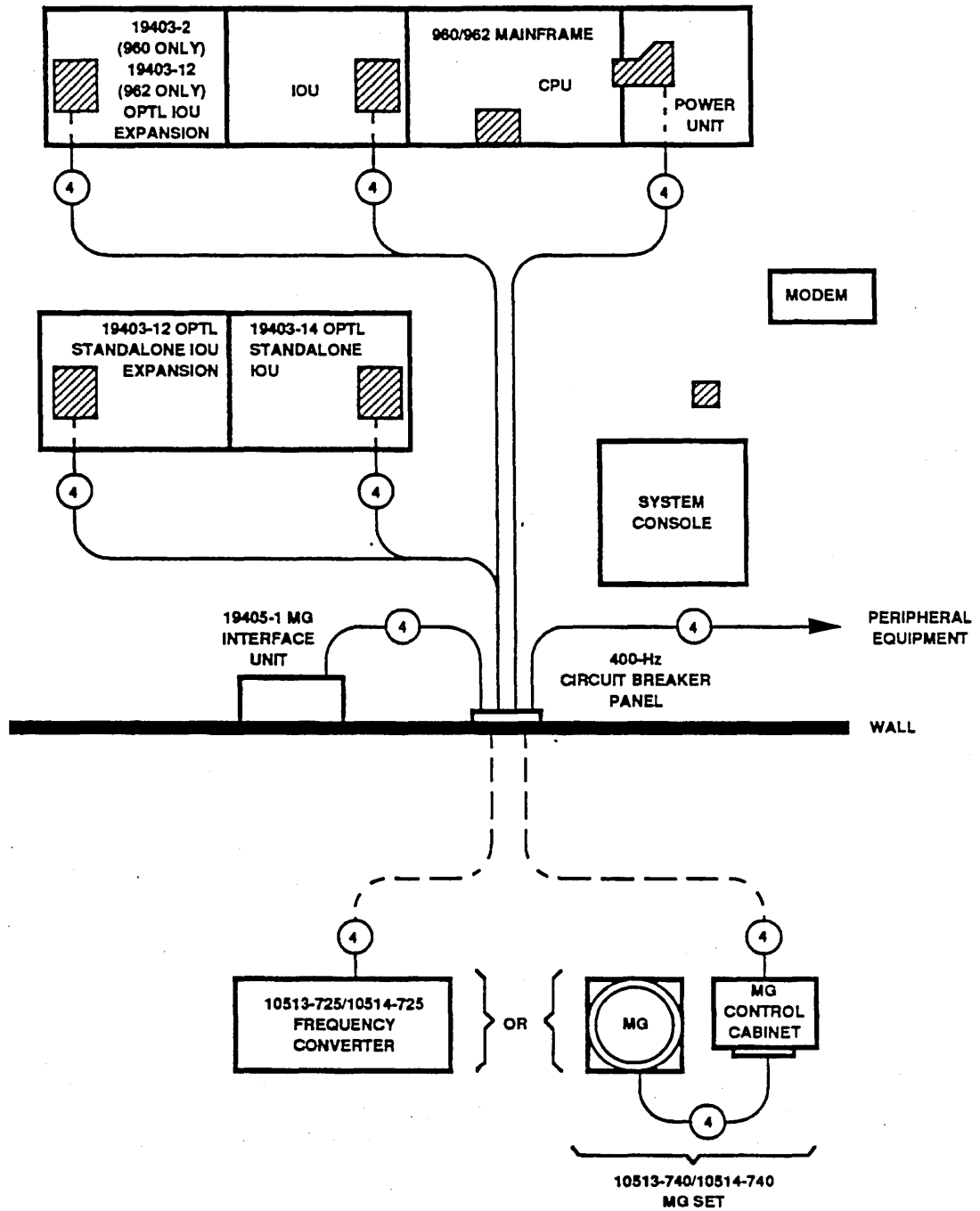
Some of the computer room equipment requires 400-Hz voltage inputs that must be from a frequency converter or an MG set, either of which is specified and approved by Control Data for use with Control Data equipment. The specified frequency converter or MG set converts 50/60-Hz to 400-Hz power and is specifically designed to operate with Control Data equipment.

Table 4-4 lists the required voltages and figure 4-2 shows the 400-Hz wiring diagram for the equipment.

What 400-Hz Input Voltage is Required for the Equipment?

Table 4-4. 400-Hz Input Voltages

Equipment	400-Hz Voltage	Phase
Mainframe:		
• Power unit	120/208	3
• CPU	N/A	N/A
• IOU	120/208	3
19403-2/19403-12 optl IOU expansion	120/208	3
19403-14 optl standalone IOU	120/208	3
19403-12 optl standalone IOU expansion	120/208	3
19405-1 MG interface unit	120/208	3
System console	N/A	N/A
RTA modem	N/A	N/A



NOTE:

—○— SYMBOL INDICATES NUMBER OF CONDUCTORS IN RUN (NOT INCLUDING SAFETY GROUND).

M02244-1

Figure 4-2. 400-Hz Wiring Diagram for Mainframe Complex

How Much 400-Hz Power Does the Equipment Consume?

The 400-Hz power that the computer room equipment consumes is listed in table 4-5. Equipment in the MG room generates, but does not consume, 400-Hz power. Use the power worksheet on the next page to help you determine the load on each frequency converter or MG. Consider future requirements when you plan the site power distribution system.

Table 4-5. 400-Hz Power Consumption

Equipment	Note	Typical Power Consumption kVA
Power unit, CP-0 and memory increments		9.3
CP-1		5.7
IOU		
19403-1 960 IOU		7.2
19403-2 960 IOU expansion with options		4.7
19403-11 962 IOU		6.3
19403-12 962 IOU expansion with options		6.0
19403-14 Optl standalone IOU		6.3
19403-12 Optl standalone IOU expansion with options		6.0
19405-1 MG interface unit	1	-
System console		None
RTA modem		None

Note:

1. Power consumption is negligible.

400-Hz Power Worksheet

Equipment	Power Consumption Each	Qty	Load on MG or Frequency Converter
960 mainframe with CP-0 and memory increments			_____
CP-1			_____
960 mainframe with optl IOU expansion and options			_____
962 mainframe with optl CP-1 and memory increments			_____
962 mainframe with optl IOU expansion and options			_____
19403-14 optl standalone IOU			_____
19403-12 optl standalone IOU expansion and options			_____
19405-1 MG interface unit			_____
System console			None
RTA Modem			None
Peripheral equipment (Note ¹):			
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
Total (Note²)	_____	_____	_____

Load fraction = Total divided by 25 (10513-725/10514-725 frequency converter used) or 40 (10513-740/10514-740 MG set used).

Notes:

1. Refer to Site Preparation Peripheral Equipment Data manual for power consumption.
2. Control Data recommends limiting the load for normal operation to 85% of the full-load rating ($0.85 \times 40 \text{ kVA} = 34 \text{ kVA}$). The recommended load provides reserve power for maintenance testing.

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How is Power Connected to Equipment in the Computer Room?

Depending on the available site power and local codes, 50/60- and 400-Hz power connects to the computer room equipment by direct wiring to terminal blocks or through power cords with plugs.

When equipment ships to a site with 50-Hz power, Control Data ships the equipment without the 50/60- and 400-Hz power cords. For a 50-Hz site installation, you must supply the power cords (one for the computer unit and one for the monitor), install wiring from the site 50- and 400-Hz circuit breakers to the mainframe equipment terminal blocks, and change the voltage setting and power cord on the system console.

When equipment ships to a site with 60-Hz power, Control Data provides 60- and 400-Hz power cords with plugs. If local codes require wiring the 60- and 400-Hz power directly to the equipment, you may remove the power cords and connect the site wiring directly to the equipment terminal blocks. If you decide to use the power plugs, you must supply mating receptacles for the 60- and 400-Hz power cord plugs. You must also supply and install wiring from the site 60- and 400-Hz circuit breakers to the equipment terminal blocks or power receptacles.

Tables 4-6 and 4-7 define the 60- and 400-Hz power cords, connectors, and mating receptacles for connector installations. The tables also define the equipment terminal block locations for direct wiring connections.

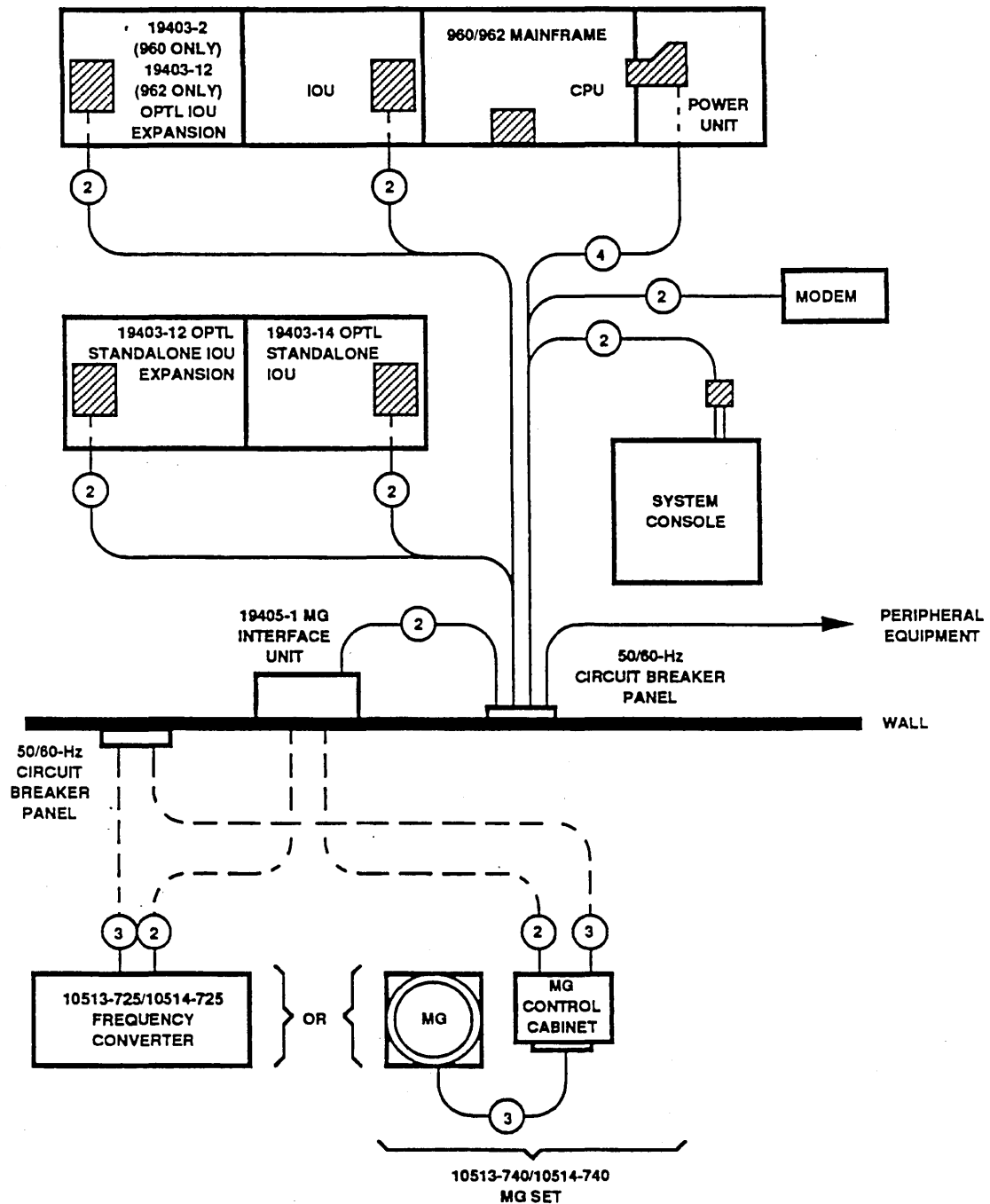
Figures 4-3 and 4-4 show the basic 50/60- and 400-Hz wiring diagrams without distinction of direct or power cord connections.

Table 4-6. 50/60-Hz Power Connections to Equipment in Computer Room

Equipment	Note	60-Hz Power Cord Length m (ft) (Note 1)	60-Hz Power Cord Plug	60-Hz Mating Receptacle or Connector	50/60-Hz Direct Wiring Terminal Block Ht. Above Raised Floor mm (in)
Mainframe:					
• Power unit		1.8 (6)	Hubbell 520P9W	Hubbell 520C9W	305 (12)
• CPU		None	None	None	None
• IOU		1.8 (6)	Hubbell 320P4W	Hubbell 320C4W	254 (10)
19403-2/19403-12 optl IOU expansion		1.8 (6)	Hubbell 320P4W	Hubbell 320C4W	254 (10)
19403-14 optl standalone IOU		1.8 (6)	Hubbell 320P4W	Hubbell 320C4W	254 (10)
19403-12 optl standalone IOU expansion		1.8 (6)	Hubbell 320P4W	Hubbell 320C4W	254 (10)
19405-1 MG interface unit	2	None	N/A	N/A	—
System console	3				
RTA modem	4				

Notes:

1. Power cord may be disconnected from terminal block and site power wiring may be directly connected to terminal block if required by local electrical code.
2. Power must be direct-wired to terminal block. Height of terminal block above raised floor depends on mounting height of unit at site.
3. Refer to system console data in appendix A.
4. Refer to RTA modem data in appendix B.



NOTES:

1. AN ENERGIZED 50/60-Hz CIRCUIT BREAKER PANEL MUST PROVIDE POWER TO THE POWER UNIT AND MG INTERFACE UNIT FOR THE POWER UNIT TO CONTROL THE MG SET.
2. THE 50/60-Hz CIRCUIT BREAKER PANEL FOR THE MG SET MUST BE VISIBLE FROM THE MG SET CONTROLLER CABINET OR FROM THE FREQUENCY CONVERTER.

—○— SYMBOL INDICATES NUMBER OF CONDUCTORS IN RUN (NOT INCLUDING SAFETY GROUND).

M02243-1

Figure 4-3. 50/60-Hz Wiring Diagram for Mainframe Complex

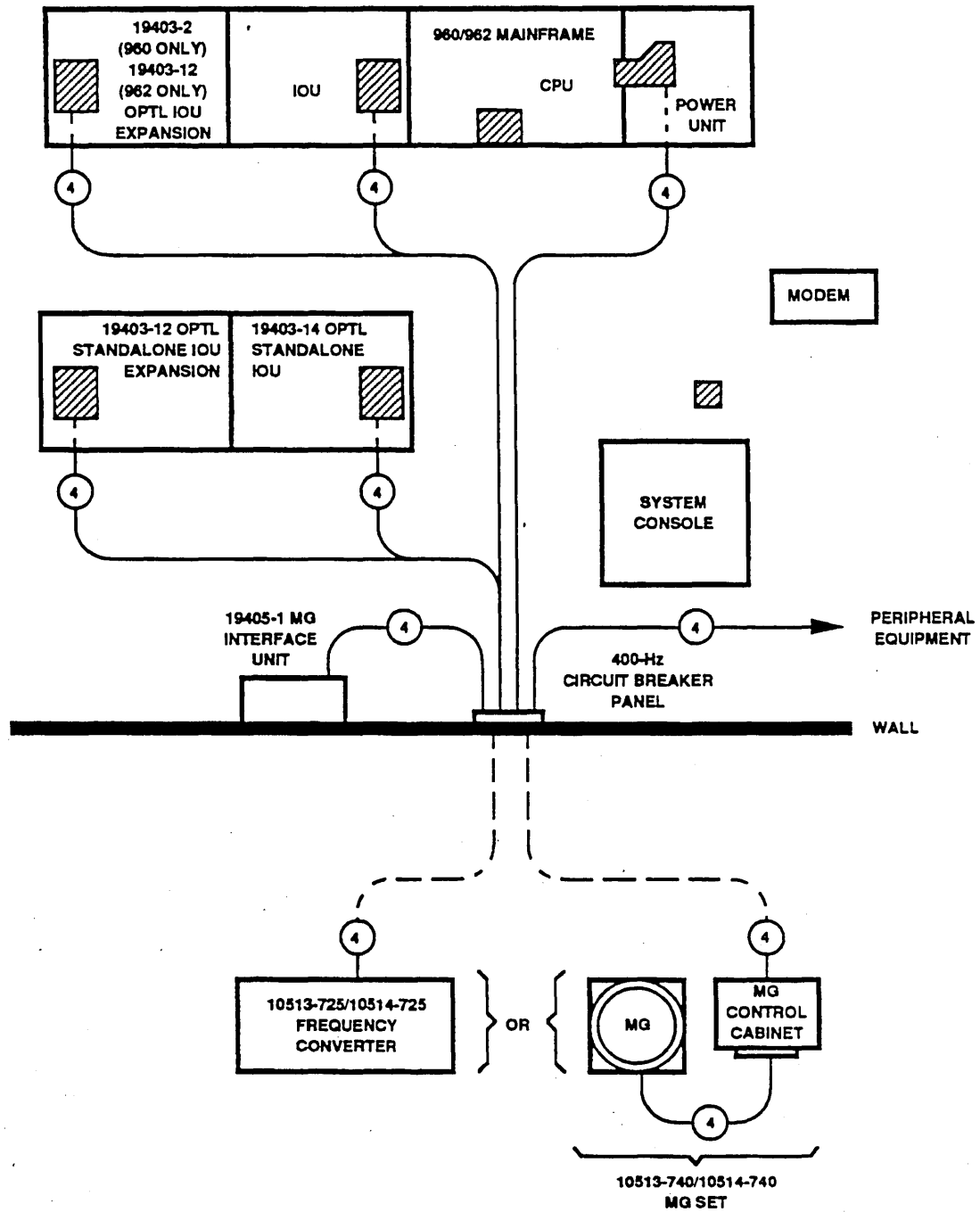
Table 4-7. 400-Hz Power Connections to Equipment in Computer Room

Equipment	Note	Power Cord Length m (ft) (Note 1)	Power Cord Plug	Mating Receptacle or Connector	Direct Wiring Terminal Block Ht. Above Raised Floor mm (in)
Mainframe:					
• Power unit		1.8 (6)	Hubbell 560P2WS	Hubbell 560C2WS	305 (12)
• CPU		None	None	None	None
• IOU		1.8 (6)	Hubbell 530P2W	Hubbell 530C2W	254 (10)
19403-2/19403-12 optl IOU expansion		1.8 (6)	Hubbell 530P2W	Hubbell 530C2W	254 (10)
19403-14 optl standalone IOU		1.8 (6)	Hubbell 530P2W	Hubbell 530C2W	254 (10)
19403-12 optl standalone IOU expansion		1.8 (6)	Hubbell 530P2W	Hubbell 530C2W	254 (10)
19405-1 MG interface unit	2	None	N/A	N/A	—
System console		None	None	None	None
RTA modem		None	None	None	None

Notes:

1. Power cord may be disconnected from terminal block and site power wiring may be directly connected to terminal block if required by local electrical code. The number of conductors in each run is indicated in the 400-Hz wiring diagram. Each run must also include a safety ground wire (refer to Grounding in chapter 4 of the Site Preparation General Information manual).

2. The MG interface unit senses 400-Hz power from up to two frequency converters or MG sets. The power distributed from the associated 400-Hz circuit breaker panel must be direct wired to the MG interface unit (height of direct wiring terminal block above raised floor depends on mounting height at site). The recommended size of the four conductors in each run is 3.3mm² (12 AWG).



NOTE:

—○— SYMBOL INDICATES NUMBER OF CONDUCTORS IN RUN (NOT INCLUDING SAFETY GROUND).

M02244-1

Figure 4-4. 400-Hz Wiring Diagram for Mainframe Complex

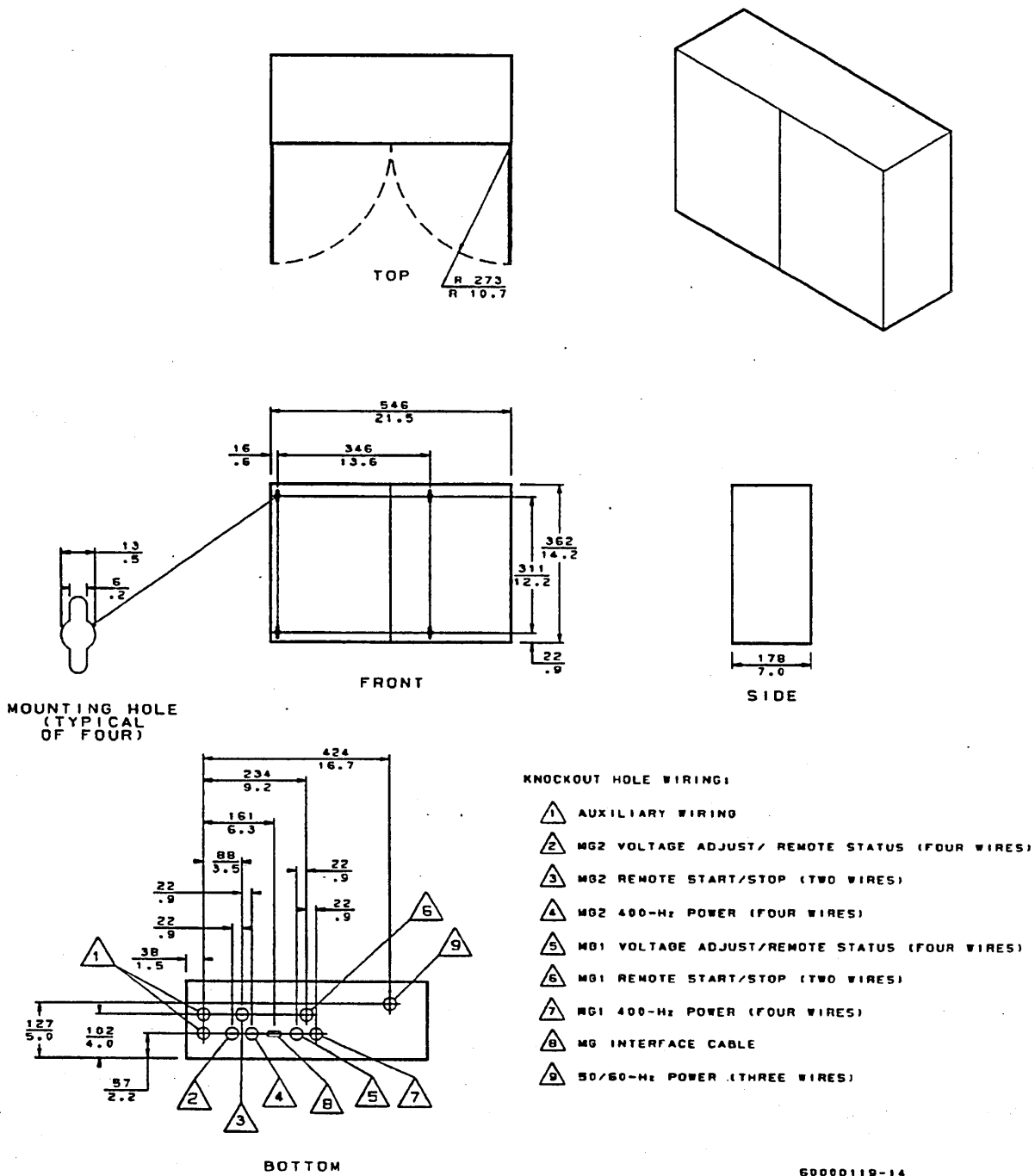
How is Power Connected to Equipment in the Computer Room?

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Where are Entry Power Locations for Direct Wiring?

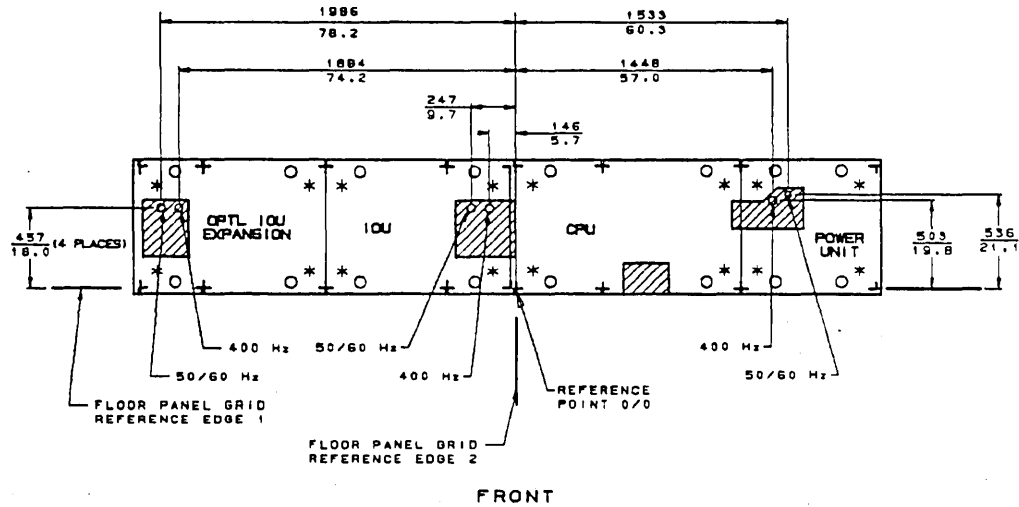
When planning to wire 50/60- and 400-Hz power directly to equipment terminal blocks, locate the power wires for the MG interface unit as shown in figure 4-5. Though figure 4-5 shows wiring knockout holes on the bottom of the MG interface unit, the unit may mount with the holes either facing down or up. Locate the power wires for the mainframe and optional IOUs as shown in figure 4-6.

Where are Entry Power Locations for Direct Wiring?



60000119-14

Figure 4-5. MG Interface Unit Direct Power Wiring Entry Locations



NOTE:

WIRE ENTRY LOCATIONS FOR THE OPTIONAL STANDALONE IOU AND STANDALONE IOU EXPANSION (NOT SHOWN) ARE THE SAME AS FOR THE IOU AND OPTIONAL IOU EXPANSION, AS REFERENCED FROM SIMILAR REFERENCE GRIDS 1 AND 2 THAT ESTABLISH A REFERENCE POINT 0/0 FOR THE STANDALONE UNITS.

60000119-03A

Figure 4-6. Mainframe Complex Direct Power Wiring Entry Locations

To present the information in this chapter in a structured format, this page has been left blank.

How is Power Connected to Equipment in the MG Room?

Power connects to equipment in the MG room by direct-wiring connections to terminal blocks.

Frequency Converter Connections

Table 4-8 lists the connections to frequency converters. The frequency converter wiring diagram is shown in figure 4-7.

You must supply and install the wiring from the site circuit breaker to the equipment terminal blocks. You must also install and test the frequency converter(s) in the local mode at least 2 weeks before delivery of the mainframe. Installation and test instructions are in the manual shipped with the frequency converter(s).

NOTE

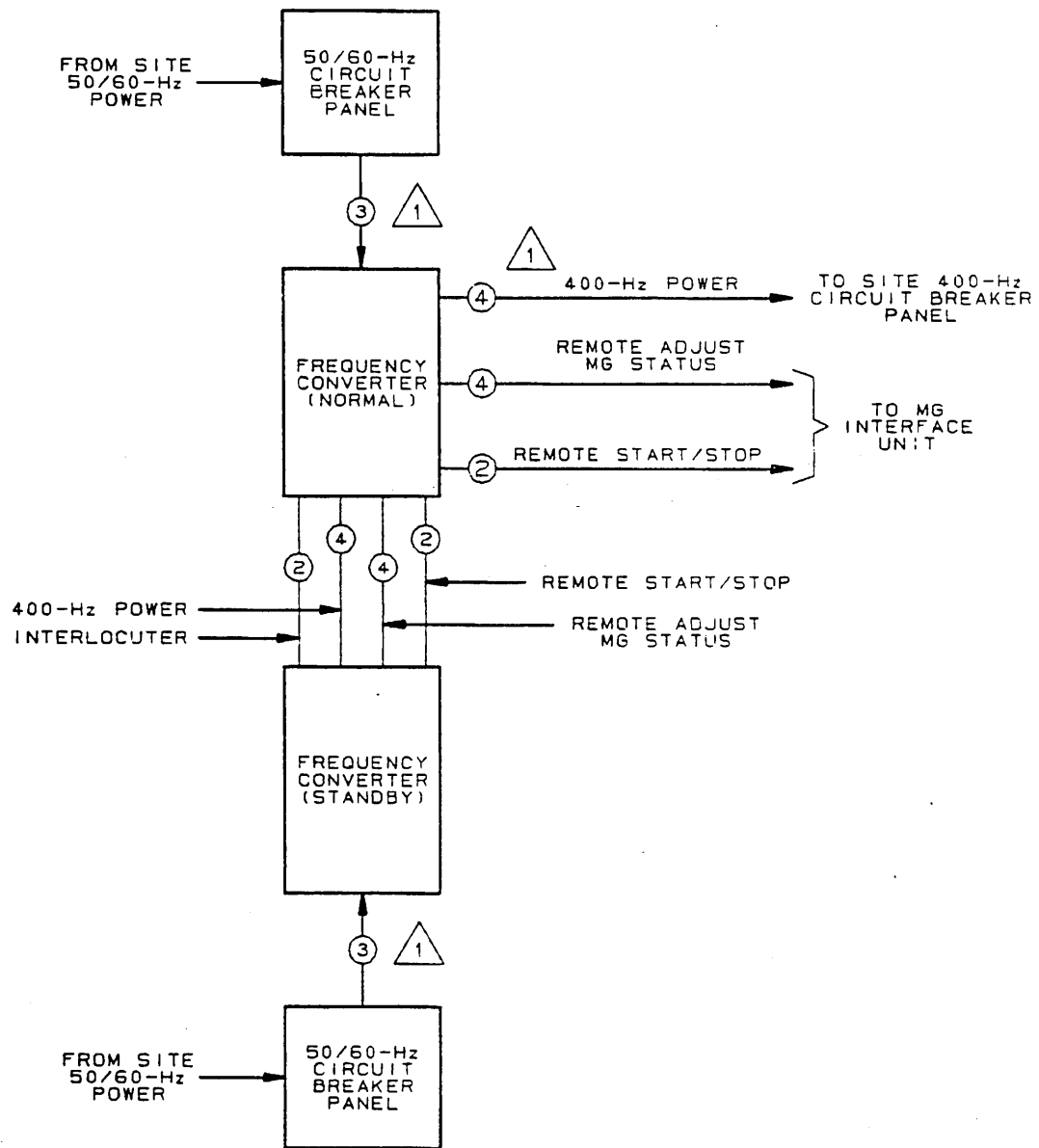
The term normal frequency converter in the following table refers to a normally active frequency converter. Also, several normal frequency converters serviced by the same standby frequency converter are referred to as adjacent frequency converters.

Table 4-8. Power Connections to 10513-725 and 10514-725 Frequency Converters

From	Terminal Strip Ht. Above Floor mm (in)	To	Terminal Strip Ht. Above Floor mm (in)	Wires Per Run	Recom- mended Wire Size Note ¹
50/60-Hz circuit-breaker panel	Site dependent	Frequency converter (normal)	1067 (42)	3 Note ²	53.5 mm ² (1/0 AWG) Note ³
400-Hz circuit-breaker panel	Site dependent	Frequency converter (normal)	711 (28)	4 Note ²	42.4 mm ² (1 AWG) Note ⁴
MG interface unit - Remote Volt. Adj./Remote Status	Site dependent	Frequency converter (normal)	1676 (66)	4	3.3 mm ² (12 AWG)
MG interface unit - Remote Start/Stop	Site dependent	Frequency converter (normal)	1422 (56)	2	3.3 mm ² (12 AWG)
Standby - 400-Hz Power	279 (11)	Frequency converter (normal)	711 (28)	4 Note ⁵	53.5 mm ² (1/0 AWG)
Standby - Interlocutor	1524 (60)	Frequency converter (normal)	2057 (81)	2 Note ⁵	3.3 mm ² (12 AWG)
Standby - Remote Control & Status	1245 (49)	Frequency converter (normal)	1676 (66)	4 Note ⁵	3.3 mm ² (12 AWG)

Notes:

1. Depends on insulated copper wire type THW at 75°C (167°F) maximum.
2. Does not include safety ground wire which must be installed with conductors in run. Refer to Grounding in chapter 4 of the Site Preparation General Information manual.
3. Recommended wire size is for all input voltages: 208, 220, 380, 400, 415, 440, or 460.
4. Based on 30.5-m (100-ft) run with three phase wires and one neutral wire. Voltage loss between the frequency converter and 400-Hz circuit-breaker panel must not exceed 2 percent of rated output. For information on calculating voltage drop, refer to Power Distribution in chapter 4 of the Site Preparation General Information manual.
5. If standby frequency converter provides 400-Hz power to adjacent frequency converter, duplicate power, Interlocutor, and Remote Control and Status wiring goes to adjacent frequency converter.



60000119-20

NOTES:

 A SAFETY GROUND WIRE MUST ALSO BE INSTALLED IN RUN.

 SYMBOL INDICATES NUMBER OF CONDUCTORS IN RUN (NOT INCLUDING SAFETY GROUND).

Figure 4-7. Frequency Converter Wiring Diagram

MG Set Connections

Table 4-9 lists the connections to MG sets. Figure 4-8 shows the MG set wiring diagram.

You must supply and install the wiring from the site circuit breaker to the equipment terminal blocks. Additionally, you must install and test the MG set(s) in the local mode at least 2 weeks before delivery of the mainframe. Installation and test instructions are in the manual shipped with the MG set(s).

NOTE

The term normal MG in the following tables refers to a normally active MG. Also, several normal MGs serviced by the same standby MG are referred to as adjacent MGs. Refer to the wiring diagram in figure 4-8.

Table 4-9. Power Connections to 10513-740 and 10514-740 MG Sets

From	Terminal Strip Ht. Above Floor mm (in)	To	Terminal Strip Ht. Above Floor mm (in)	Wires Per Run	Recom- mended Wire Size (Note ¹)
50/60-Hz circuit-breaker panel	Site dependent	MG control cabinet (normal)	762 (30)	3 Note ²	Note ³
400-Hz circuit-breaker panel	Site dependent	MG control cabinet (normal)	940 (37)	4 Note ²	42.4 mm ² (1 AWG) Note ⁴
MG interface unit – Remote Volt. Adj./Remote Status	Site dependent	MG control cabinet (normal)	1245 (49)	4	3 mm ² (12 AWG)
MG interface unit – Remote Start/Stop	Site dependent	MG control cabinet (normal)	1245 (49)	2	3 mm ² (12 AWG)
Motor: • Kato • Piller	889 (35) 889 (35)	MG control cabinet (normal)	152 (6)	3	Note ²
Exciter: • Kato • Piller	Note ⁵ Note ⁵	MG control cabinet (normal)	1245 (49)	2	3 mm ² (12 AWG)
Generator: • Kato • Piller	Note ⁵ Note ⁵	MG control cabinet (normal)	940 (37)	4	67 mm ² (2/0 AWG)

(Continued)

Table 4-9. Power Connections to 10513-740 and 10514-740 MG Sets (Continued)

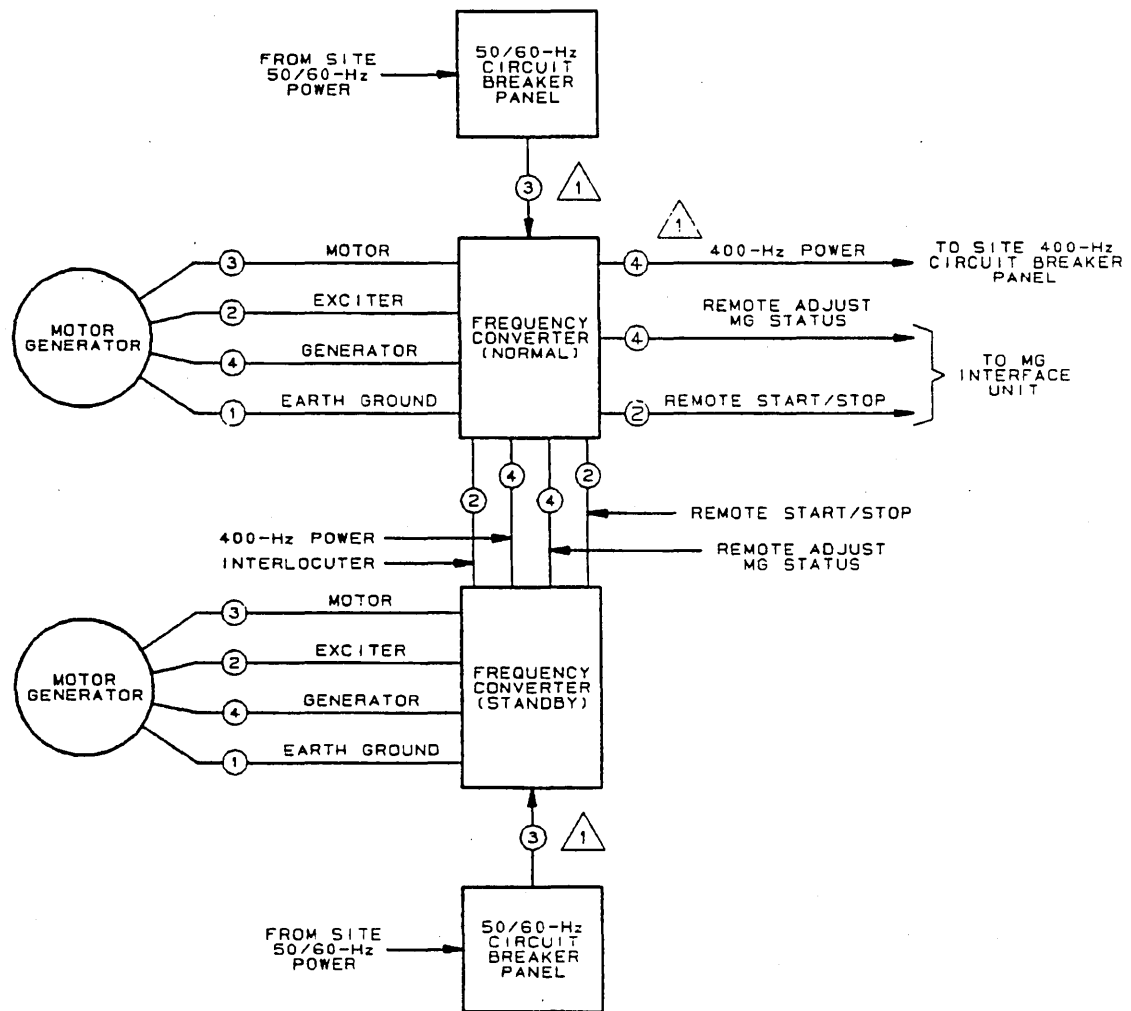
From	Terminal Strip Ht. Above Floor mm (in)	To	Terminal Strip Ht. Above Floor mm (in)	Wires Per Run	Recom- mended Wire Size (Note ¹)
Standby - 400-Hz Power Note ⁶	940 (37)	MG control cabinet (normal)	940 (37)	4	67 mm ² (2/0 AWG)
Standby - Interlocutor	1245 (49)	MG control cabinet (normal)	1245 (49)	2 Note ⁶	3 mm ² (12 AWG)
Standby - Remote Control & Status	1245 (49)	MG control cabinet (normal)	1245 (49)	6 Note ⁶	3 mm ² (12 AWG)

Notes:

1. Based on insulated copper wire type THW at 75°C (167°F) maximum.
2. Does not include safety ground wire which must be installed with conductors in run. Refer to Grounding in chapter 4 of the Site Preparation General Information manual.
3. Recommended wire size is 107 mm² (4/0 AWG) for 208, 220, 230, or 240 input voltages; 33.6 mm² (2 AWG) for 380, 400, or 415 input voltages; and 26.7 mm² (3 AWG) for 440 or 460 input voltages.
4. Based on 30.5-m (100-ft) run with three phase wires and one neutral wire. Voltage loss between the MG control cabinet and 400-Hz circuit-breaker panel must not exceed 2 percent of rated MG output. For information on calculating voltage drop, refer to Power Distribution in chapter 4 of the Site Preparation General Information manual.
5. This equipment does not have terminal strips. Power connections are directly to wires located inside a terminal box that is within 1118 mm (44 in) above the floor.
6. If standby MG control cabinet provides 400-Hz power to adjacent control cabinet, duplicate power, Interlocutor, and Remote Control and Status wiring goes to adjacent control cabinet.

How is Power Connected to Equipment in the MG Room?

To present the information in this chapter in a structured format, this page has been left blank.



60000119-19

NOTES:



-  A SAFTEY GROUND WIRE MUST ALSO BE INSTALLED IN RUN.
-  SYMBOL INDICATES NUMBER OF CONDUCTORS IN RUN
(NOT INCLUDING SAFTEY GROUND).

Figure 4-8. MG Set Wiring Diagram

How to Wire Power and Control to the MG Interface Unit

Power and control wires enter the MG interface unit through electrical knockout holes. The unit mounts in either of two ways so that the knockout holes face upward or downward to permit wiring to enter the unit from the top or bottom.

Figure 4-9 identifies the wires for each knockout hole. The MG Interface Unit manual (listed in the front of this manual under Related Manuals) ships with the unit and defines the electrical connections and checkout of the unit with the frequency converter or MG set.

CAUTION

Do not apply power to the MG interface unit until after Control Data performs the preinstallation checks during the mainframe complex installation.

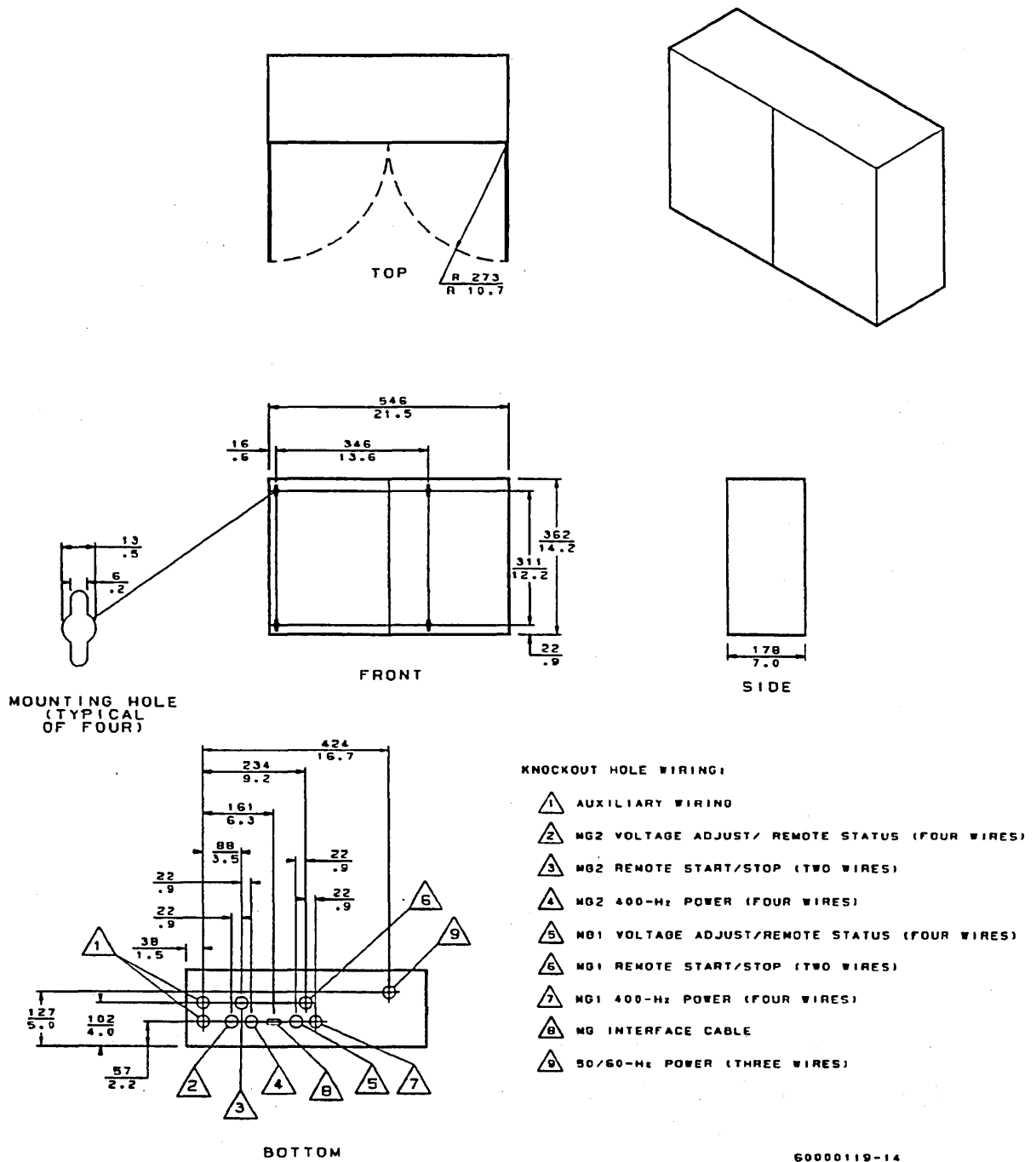


Figure 4-9. MG Interface Unit Wiring Connections

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What Power Items Must You Supply?

The power items that you must supply for preinstallation are listed in tables 4-10 and 4-11. You must install these items on your site power distribution system at least 2 weeks before delivery of the mainframe. Additionally you must:

- Supply and install the required disconnects, circuit-breaker panels, magnetic contactors, emergency-off switches, and convenience outlets for test equipment.
- Prepare a diagram of the site power distribution system for Control Data Engineering Services personnel to use while installing, maintaining, and servicing the mainframe complex and peripheral equipment. On the diagram, identify by number the equipment, circuit-breaker panels, and circuit breakers.

Table 4-10. Customer-Supplied Power Connectors

Qty	Note	60-Hz Receptacle or Connector	400-Hz Receptacle or Connector	Equipment
1	1	Hubbell 520C9W	Hubbell 560C2WS	Power unit
1	1	Hubbell 320C4W	Hubbell 530C2W	IOU
1	1	Hubbell 320C4W	Hubbell 530C2W	19403-2/19403-12 optl IOU expansion
1	1	Hubbell 320C4W	Hubbell 530C2W	19403-14 optl standalone IOU
1	1	Hubbell 320C4W	Hubbell 530C2W	19403-12 optl standalone IOU expansion
1	2			System console
1	3			RTA modem

Notes:

1. Required for all system configurations that use power cord plug connections.
2. Refer to system console data in appendix A.
3. Refer to RTA modem data in appendix B.

Table 4-11. Customer-Supplied Circuit Breakers

Qty	Note	Freq. Hz	Voltage	Rating Amps	Poles	Protects
1	1,2	50	380 to 415	150	3	10514-725 frequency converter
1	1,2	60	208 to 240	250	3	10513-725 frequency converter
1	1,2	60	440 to 480	125	3	10513-725 frequency converter
1	1,2	50	220 to 240	350	3	10514-740 MG set
1	1,2	50	380 to 415	200	3	10514-740 MG set
1	1,2	60	208 to 240	350	3	10513-740 MG set
1	1,2	60	440 to 480	175	3	10513-740 MG set
1	1	50	220/380 or 240/415	16	3	Power unit
1	1	60	120/208	20	3	Power unit
1	1	400	120/208	50	3	Power unit
1	1	50	220 to 240	16	1	IOU
1	1	60	120	20	1	IOU
1	1	400	120/208	30	3	IOU
1	1	50	220 to 240	16	1	19403-2/12 optl IOU expansion
1	1	60	120	20	1	19403-2/12 optl IOU expansion
1	1	400	120/208	30	3	19403-2/12 optl IOU expansion
1	1	50	220 to 240	16	1	19403-14 optl standalone IOU
1	1	60	120	20	1	19403-14 optl standalone IOU
1	1	400	120/208	30	3	19403-14 optl standalone IOU
1	1	50	220 to 240	16	1	19403-12 optl standalone IOU expansion
1	1	60	120	20	1	19403-12 optl standalone IOU expansion
1	1	400	120/208	30	31	19403-12 optl standalone IOU expansion
1	1	50	220 to 240	16	1	19405-1 MG interface unit
1	1	60	120	15	1	19405-1 MG interface unit
1	1	400	120/208	15	3	19405-1 MG interface unit
-	3	-	-	-	-	System console
-	4	-	-	-	-	RTA modem

Notes:

1. Select only the applicable circuit breakers for the equipment configuration.
2. Use an inverse-time circuit breaker.
3. Refer to system console data in appendix A.
4. Refer to RTA modem data in appendix B.

Communications Requirements **5**

What RTA Items Does Control Data Supply? 5-2

What RTA Items Must You Supply? 5-3

Communications Requirements

5

This chapter contains lists of items that Control Data supplies and that you must supply for the remote technical assistance (RTA) communications option.

Chapter 5 of the Site Preparation General Information manual contains information on Control Data Distributed Communications Network (CDCNET), Loosely Coupled Network (LCN), and RTA.

Use the information in these manuals to plan the RTA installation.

What RTA Items Does Control Data Supply?

Control Data supplies one of each of the following items for the RTA option.

- Modem, 2400 bits/s, V.22bis-compatible.
- Signal cable – 15.2 m (50 ft) long. Connects modem to system console.
- Telephone cable – 2.1 m (7 ft) long. Connects modem to telephone jack.

A customer engineer delivers and installs the RTA items when the mainframe is installed. Figure 5-1 shows the RTA cable diagram.

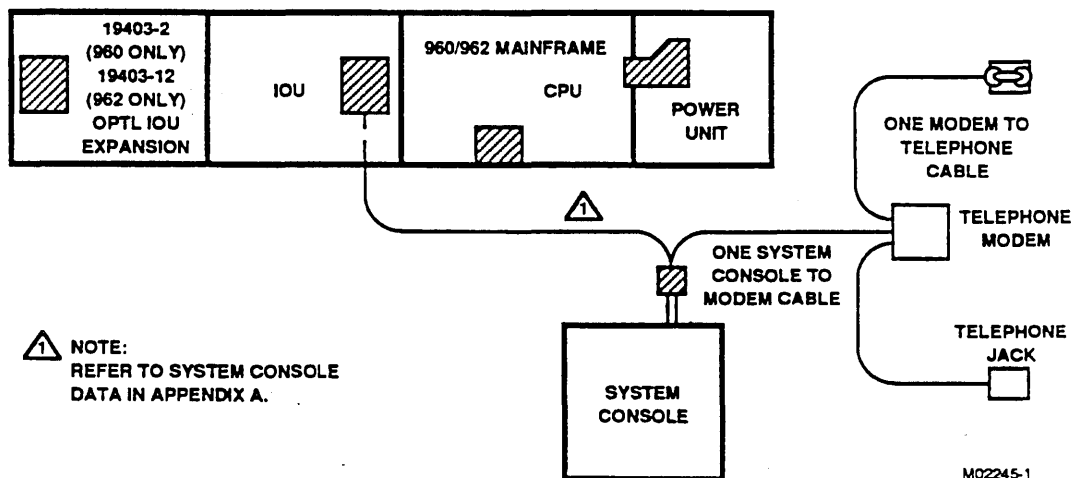


Figure 5-1. RTA Cable Diagram

What RTA Items Must You Supply?

You must supply one each of the following items.

- Telephone line, voice grade, tone or pulse dial for voice and data communications between site and remote support office.
- Telephone jack (RJ11C in U.S. or Canada) for connecting modem to telephone line.
- Telephone for voice communication between site and remote support office.
- Telephone cable with plug to mate with telephone jack on modem.

The items must be available 1 week before the mainframe installation. Figure 5-1 shows the RTA cable diagram.

For RTA installation in the U.S., give the following information to the local telephone company:

- Telephone number of line to which the modem is connected.
- Type of telephone jack (RJ11C).
- Manufacturer and model number of modem.
- FCC registration number of modem.
- Ringer equivalence number (REN) of modem.

Refer to the manual supplied with the modem for the FCC registration number and the ringer equivalence number.

Reports

6

What are the Site Delivery Conditions?	6-3
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Site Data Report (Sheet 2 of 2)	6-4
Is the Site Ready for the Equipment?	6-5
Site Readiness Report (Sheet 1 of 2)	6-5
Site Readiness Report (Sheet 2 of 2)	6-6

This chapter contains the Site Data Report for reporting any problems with equipment delivery to your site and the Site Readiness Report for reporting that the site is ready for equipment installation. Fill in these reports near the end of your site preparations.

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What are the Site Delivery Conditions?

Forty-five days before the equipment is to arrive, fill in the Site Data Report and send it to your Control Data Technical Services installation coordinator. Use the Site Data Report to identify any problems with delivering the equipment to your site. Please answer all questions in the report. If a question does not apply to your site, write "N/A" on the blank line.

NOTE

Control Data fills in the corporate file number (CFN).

Site Data Report (Sheet 1 of 2)

Corporate File Number _____

Customer Information

Customer name _____

Street address _____

City _____ State _____ Zip code _____

Contact name _____

Telephone number _____

General Information

Site is in building number _____

Computer room is on floor number _____ in room number _____

M-G room is on floor number _____ in room number _____

Special delivery date or time is required? Yes ____ No ____

If Yes: Date _____ Time _____

Security clearance is required? Yes ____ No ____

Dock

Equipment will be unloaded to a dock? Yes ____ No ____

Dock is accessible to a 65-ft tractor-trailer
(tractor-trailer is 13 ft, 6 in high)? Yes ____ No ____

Site Data Report (Sheet 2 of 2)

Building Entrance (If No Dock)

Distance from unloading point to building entrance is _____ m/ft.

Surface from unloading point to building entrance is _____.

[Choose one] (cement) (black top) (grass) (other - explain)

Stairway or ramp is at building entrance? Yes ____ No ____

Building Interior

Distance from building entrance (or dock) to computer room _____ m/ft.
is

Distance from building entrance (or dock) to M-G room is _____ m/ft.

Floor protection is required for moving equipment across carpeting and raised floor? Yes ____ No ____

Stairway or ramp is on route to computer room? Yes ____ No ____

Stairway or ramp is on route to M-G room? Yes ____ No ____

Smallest hallway on route to computer room is _____ mm/in wide.

Equipment must be moved through 90° turn in hallway? Yes ____ No ____

Ramp is required to move equipment onto raised floor of computer room? Yes ____ No ____

Customer will supply ramp? Yes ____ No ____

Elevator

Elevator is required to move equipment to computer room or M-G room? Yes ____ No ____

Elevator box is _____ mm/in wide, _____ mm/in deep.

Elevator door is _____ mm/in wide, _____ mm/in high.

Elevator load capacity is _____ kg/lb.

Is the Site Ready for the Equipment?

Two weeks before the equipment is to arrive, the site must be ready to meet the space, environmental, power, and communications requirements of the mainframe complex.

Use the Site Readiness Report to help you verify that the site is ready. In the "Yes" column, make a checkmark if the item has been completed, or write "N/A" if the item is not applicable. Completing this report does not mean that your site meets all of the requirements nor that Control Data approves the design of your site.

Site Readiness Report (Sheet 1 of 2)

	Notes	Yes
Space Requirements		
Room construction completed?	_____	_____
Copies of scaled diagram of equipment layout available for contractors and Control Data Technical Services personnel?	_____	_____
Nonstandard cables for peripheral equipment ordered, if required?	_____	_____
Location of equipment marked on raised floor?	_____	_____
Floor cutouts made?	_____	_____
Extra floor panels available?	_____	_____
Stringer clamping bolts torqued according to manufacturer's specifications?	_____	_____
Site Data Report completed and returned to Control Data?	_____	_____
Environmental Requirements		
Air conditioning system installed and tested?	_____	_____
Air distribution system operational?	_____	_____
Air filtering system installed and cleaned?	_____	_____
Environmental monitors and alarms installed?	_____	_____
Lighting installed?	_____	_____
Acoustical treatment installed, if required?	_____	_____

Site Readiness Report (Sheet 2 of 2)

	Notes	Yes
Power Requirements		
Circuit-breaker panels installed and wired?	_____	_____
Wiring from circuit-breaker panels to equipment completed?	_____	_____
Safety grounds installed?	_____	_____
Power connectors installed, unless prohibited by local electrical code?	_____	_____
Power cord plugs, receptacles, disconnects, and magnetic contactors installed?	_____	_____
Emergency-off switches installed at room exits?	_____	_____
Convenience outlets installed for test equipment?	_____	_____
Frequency converter(s) or MG set(s) installed, tested in local mode, and checked in local mode for proper rotation?	_____	_____
Diagram of site power distribution system available for Control Data Technical Services personnel? Equipment, circuit-breaker panels, and circuit breakers identified by numbers on the diagram?	_____	_____
Communications Requirements		
Telephone line, telephone jack, and telephone installed for RTA?	_____	_____

Appendixes

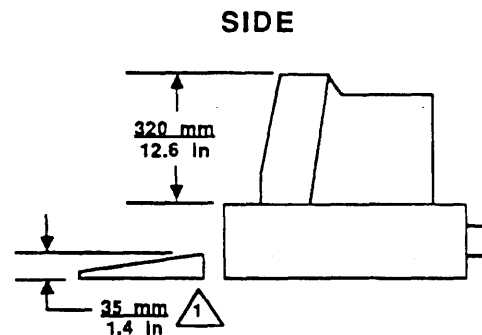
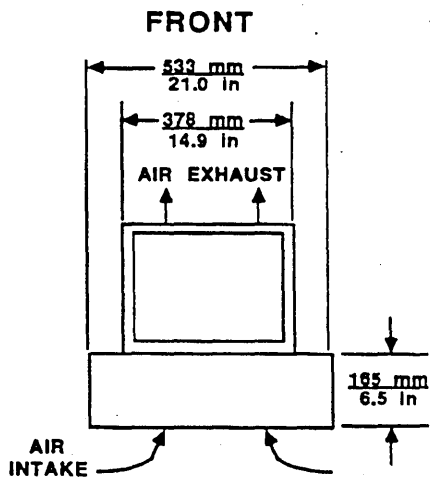
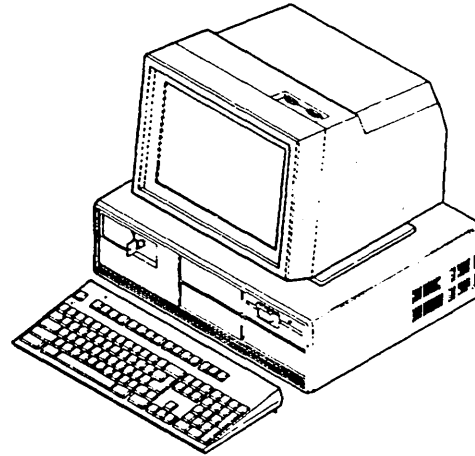
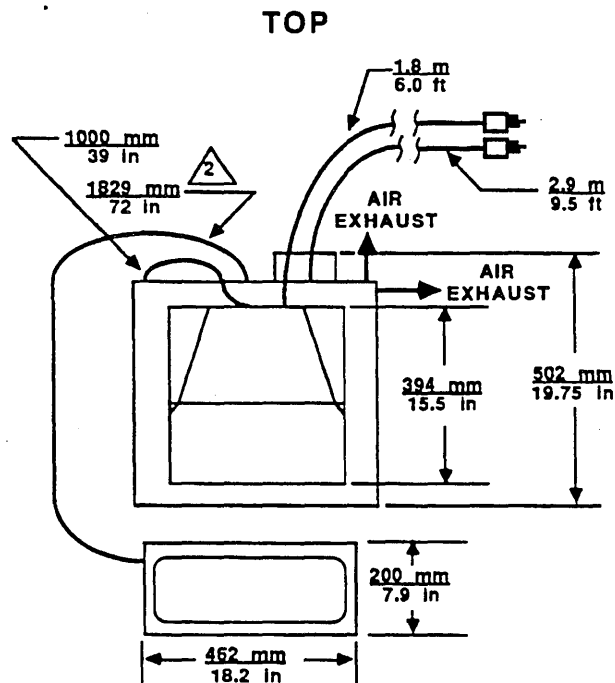
System Console Data Sheets	A-1
RTA Equipment Data Sheets	B-1
Grids and Templates	C-1

System Console Data Sheets

A

This appendix contains data sheets that provide space, environmental, and power data for the system consoles. The data sheets include an isometric view and profile views of the corresponding console.

19003-2/3 System Consoles



NOTES:

- 1 MAXIMUM HEIGHT WITH KEYBOARD FEET DOWN.
- 2 COILED LENGTH. EXTENDED LENGTH IS 2743 mm (108 in).

X04170

Space Specifications

Shipping Container Dimensions		Monitor/Microcomputer/Keyboard		
	Width	737 mm (29 in)		
	Depth	1067 mm (42 in)		
	Height	635 mm (25 in)		
Device Dimensions		Microcomputer	Monitor	Keyboard
	Width	533 mm (21.0 in)	376 mm (14.8 in)	462 mm (18.2 in)
	Depth	502 mm (19.75 in)	394 mm (15.5 in)	200 mm (7.9 in)
	Height	165 mm (6.5 in)	310 mm (12.2 in)	35 mm (1.4 in)

Service Clearances¹

Front	762 mm (30 in) from microcomputer
Rear	152 mm (6 in) from microcomputer
Right	76 mm (3 in) from microcomputer
Left	76 mm (3 in) from microcomputer
Top	76 mm (3 in) above monitor

Weights

Microcomputer	16 kg (35.3 lb)
Monitor	19.5 kg (43 lb)
Keyboard	2.1 kg (4.7 lb)
Microcomputer/Keyboard/shipping container	24.9 kg (55 lb)
Monitor/shipping container	21.8 kg (48 lb)

Floor Cutouts

Quantity	1
Size	64 x 102 mm (2.5 x 4 in)
Location	Behind table console sits on

Signal Cables ²	Quantity	Length	System Console to Table Distance
Channel cables	2	15.2 m (50 ft)	102 mm (4 in) ³
SCSI cables (962)	1	12.2 m (40 ft) ⁴	102 mm (4 in) ³

Notes:

1. Service clearances with monitor set on top of microcomputer.
2. Supplied by Control Data.
3. Add height of table to get height above raised floor.
4. Maximum for single IOU is (24.4 m) 80 ft.

Environmental Specifications

Operating Environment

Temperature	10°C to 32°C (50°F to 90°F)
Relative Humidity	20% to 80%

Nonoperating Environment

Temperature	-40°C to 60°C (-40°F to 140°F)
Relative Humidity	5% to 95%

Noise/Heat Considerations

Noise (ECMA-109) idle (60 Hz)	<u>5.3</u>	bels/	<u>45</u>	dBa
Noise (ECMA-109) opr (60 Hz)	<u>5.6</u>	bels/	<u>47</u>	dBa
Heat output to air ⁵	<u> </u>	BTU/hr	<u> </u>	W
Airflow from console ⁵	<u> </u>	BTU/hr	<u> </u>	W

Note:

5. To be supplied in a later revision.

Power Specifications

Switching Power Supply

This device contains a switching power supply. See Special Power Distribution in chapter 4 of the Site Preparation General Information manual.

Power Requirements		50 Hz	60 Hz
	Volts	220/240	120
	Phase	1	1
	kVA	0.748/0.816	0.816
Power Connections		50 Hz	60 Hz
Microcomputer:			
	Plug	Note ⁶	NEMA 5-15P ⁷
	Receptacle	Note ⁶	NEMA 5-15R ⁶
	Power cord length	2.9 m (9.5 ft)	2.9 m (9.5 ft)
Monitor:			
	Plug	Note ⁶	NEMA 5-15P ⁶
	Receptacle	Note ⁶	NEMA 5-15R ⁶
	Power cord length	2.9 m (9.5 ft)	2.9 m (9.5 ft)
Recommended Circuit Breakers ⁶		50 Hz	60 Hz
	Quantity	1	1
	Poles	1	1
	Amp rating	15	15

Notes:

6. Supplied by customer.

7. Supplied by Control Data.

RTA Equipment Data Sheets

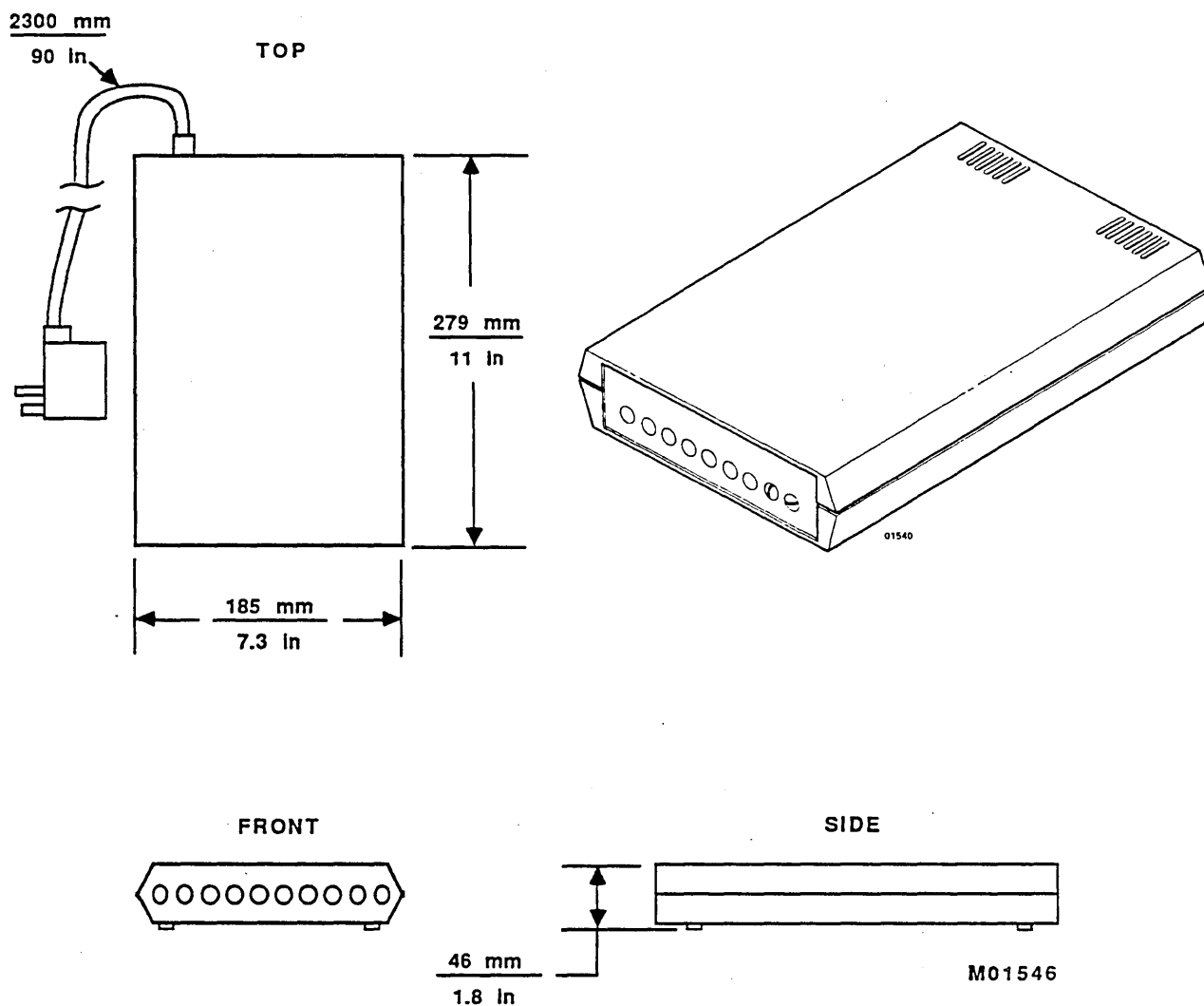
B

This appendix contains data sheets for the optional RTA modem (U.S. and Canada). The data sheets provide space, environmental, and power data.

NOTE

RTA modems used outside the U.S. or Canada may vary from the modem documented in the data sheets. Contact your local Control Data representative.

RTA Modem (U.S. and Canada)



NOTE:

SPECIFICATIONS ARE FOR MODEMS USED IN U.S. AND CANADA;
SPECIFICATIONS FOR MODEMS USED IN OTHER COUNTRIES MAY VARY.
CONTACT YOUR LOCAL CONTROL DATA REPRESENTATIVE.

Space Specifications

Device Dimensions¹

Width	185 mm (7.3 in)
Depth	279 mm (11 in)
Height	46 mm (1.8 in)

Service Clearances¹

Front	305 mm (12 in)
Rear	152 mm (6 in)
Right	0 mm (0 in)
Left	0 mm (0 in)
Top	0 mm (0 in)

Weights¹

Device	1 kg (2 lb)
--------	-------------

Floor Cutout

Quantity	None
----------	------

Signal Cables ²	Quantity	Length	Connector to Floor
RTA cable to telephone jack	1	2.1 m (7 ft)	25 mm (1 in) ³
Signal cable to system console	1	15.2 m (50 ft)	25 mm (1 in) ³

Notes:

1. Specifications for other countries may vary. Contact your local Control Data representative.
2. Supplied by Control Data.
3. Add height of table to get height above raised floor.

Environmental Specifications

Operating Environment⁴

Temperature	10°C to 40°C (50°F to 104°F)
Relative Humidity	20% to 80%

Nonoperating Environment⁴

Temperature	4°C to 60°C (40°F to 140°F)
Relative Humidity	5% to 95%

Noise/Heat Considerations⁴

Noise (ECMA-109) opr (60 Hz)	Negligible
Heat output to air	0.02 kW (70 Btu/h)

Note:

4. Specifications for other countries may vary. Contact your local Control Data representative.

Power Specifications

Switching Power Supply

This device does not contain a switching power supply. No special power distribution is required.

Power Requirements ⁵		50 Hz	60 Hz
	Volts	N/A	120
	Phase	N/A	1
	kVA	N/A	0.02
Power Connections ⁵		50 Hz	60 Hz
	Plug	N/A	NEMA 5-15P ⁶
	Receptacle	N/A	NEMA 5-15R ⁷
	Power cord length	N/A	2.3 m (7.5 ft)
Recommended Circuit Breaker ^{5,7}		50 Hz	60 Hz
	Quantity	N/A	1
	Poles	N/A	1
	Amp rating	N/A	15

Notes:

5. Specifications for other countries may vary. Contact your local Control Data representative.

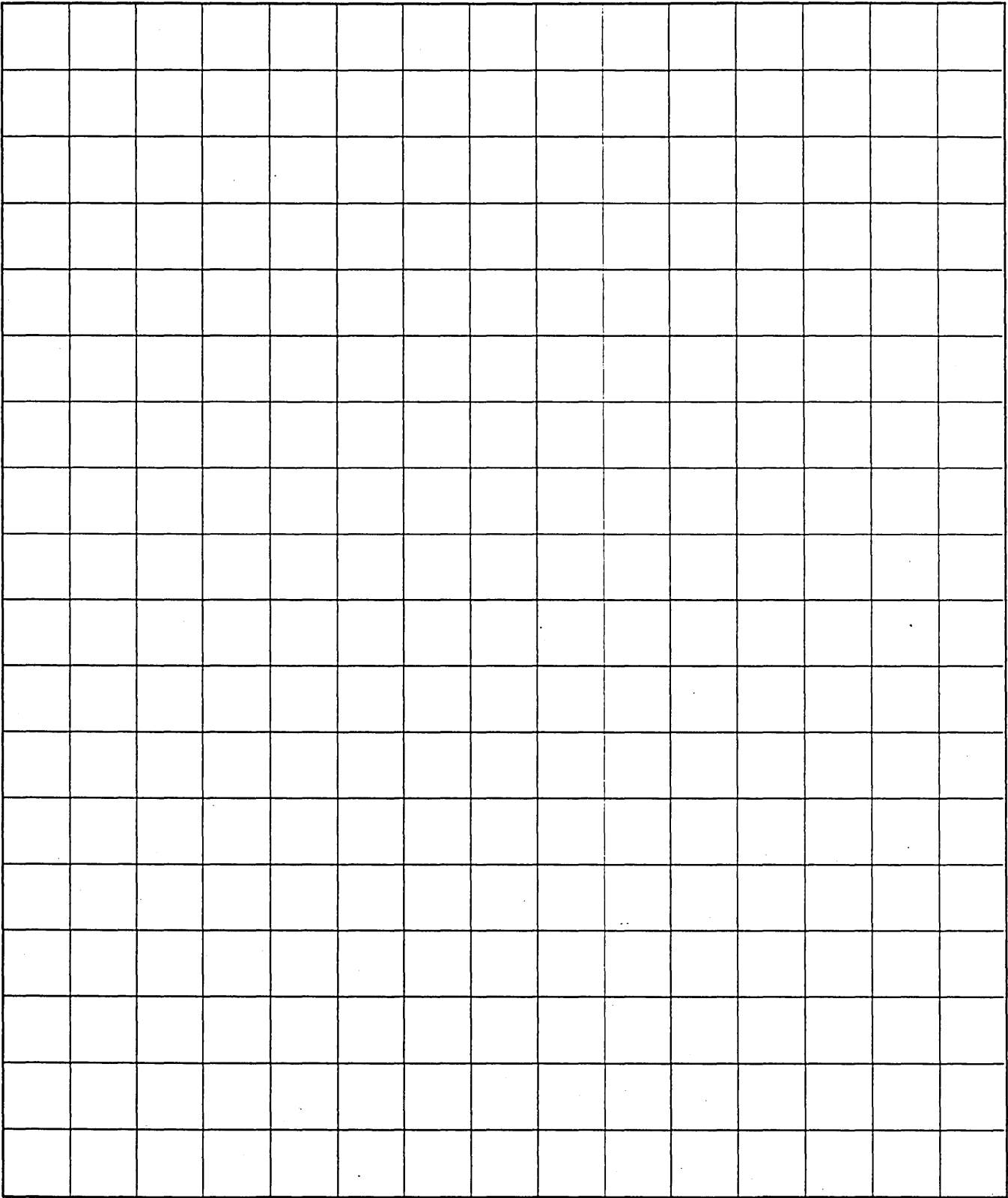
6. Supplied by Control Data.

7. Supplied by customer.

This appendix contains three sets of scaled grids and templates of the mainframe complex equipment (except MG sets). The grids and templates are scaled 12 mm = 600 mm (1/50 scale) for SI metric units and 1/2 in = 24 in (1/48 scale) for U.S. customary units.

Use the grids and templates to plan the equipment layout on the raised floor of the computer room. For instructions, refer to How to Use the Scaled Grids and Templates in chapter 2 of this manual.

To present the information in this chapter in a structured format, this page has been left blank.

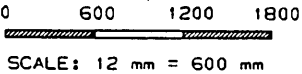
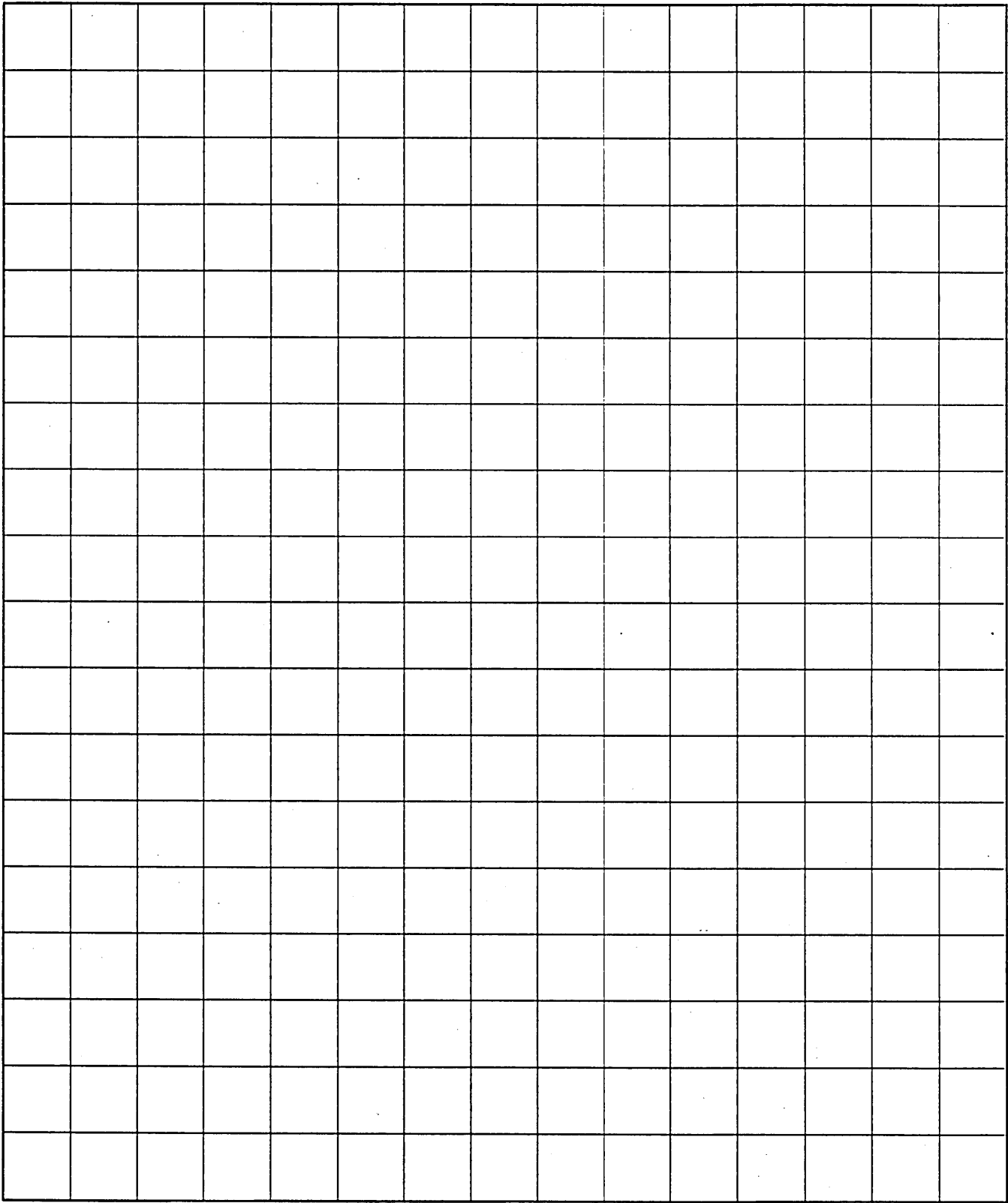


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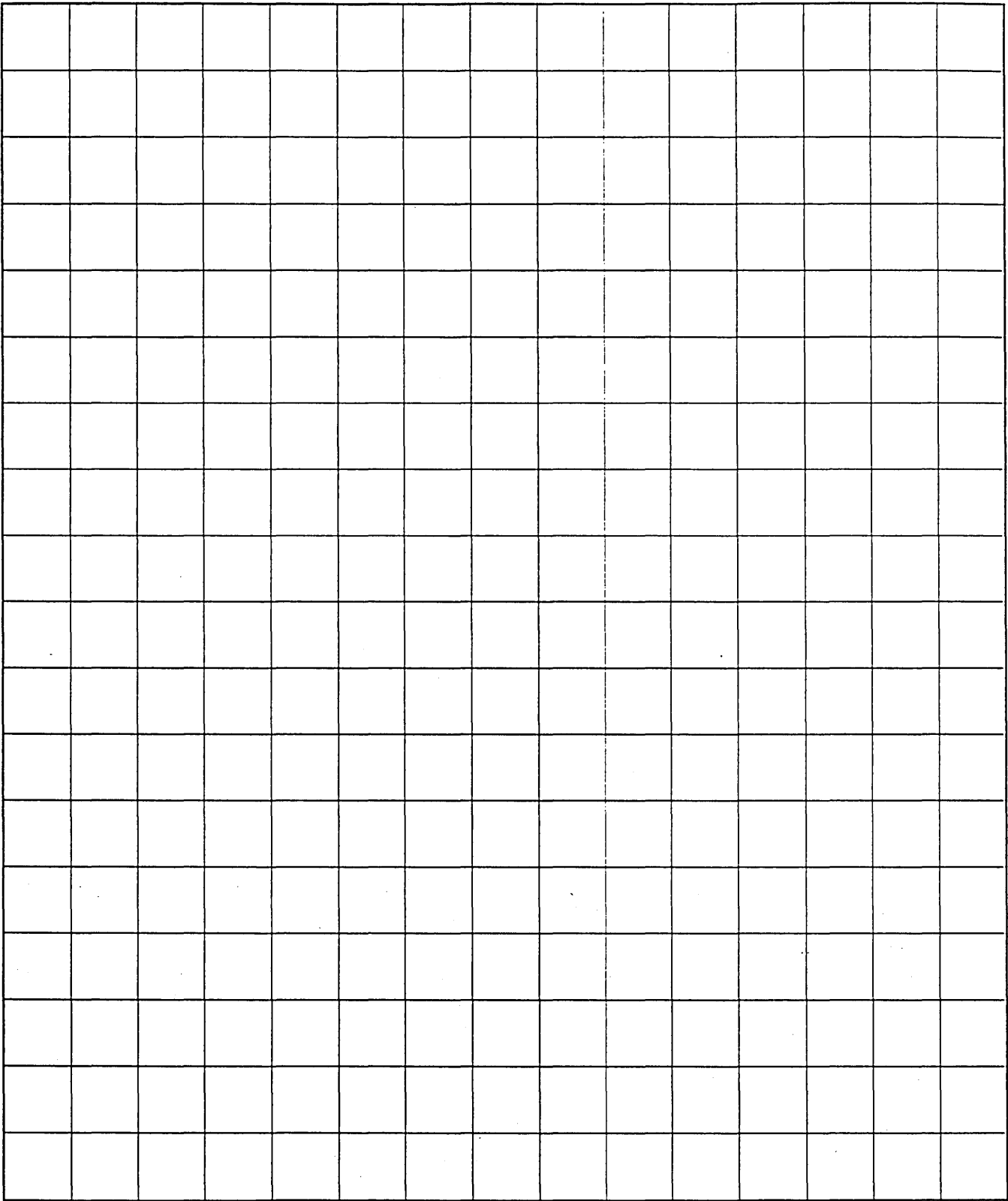


SCALE: 12 mm = 600 mm

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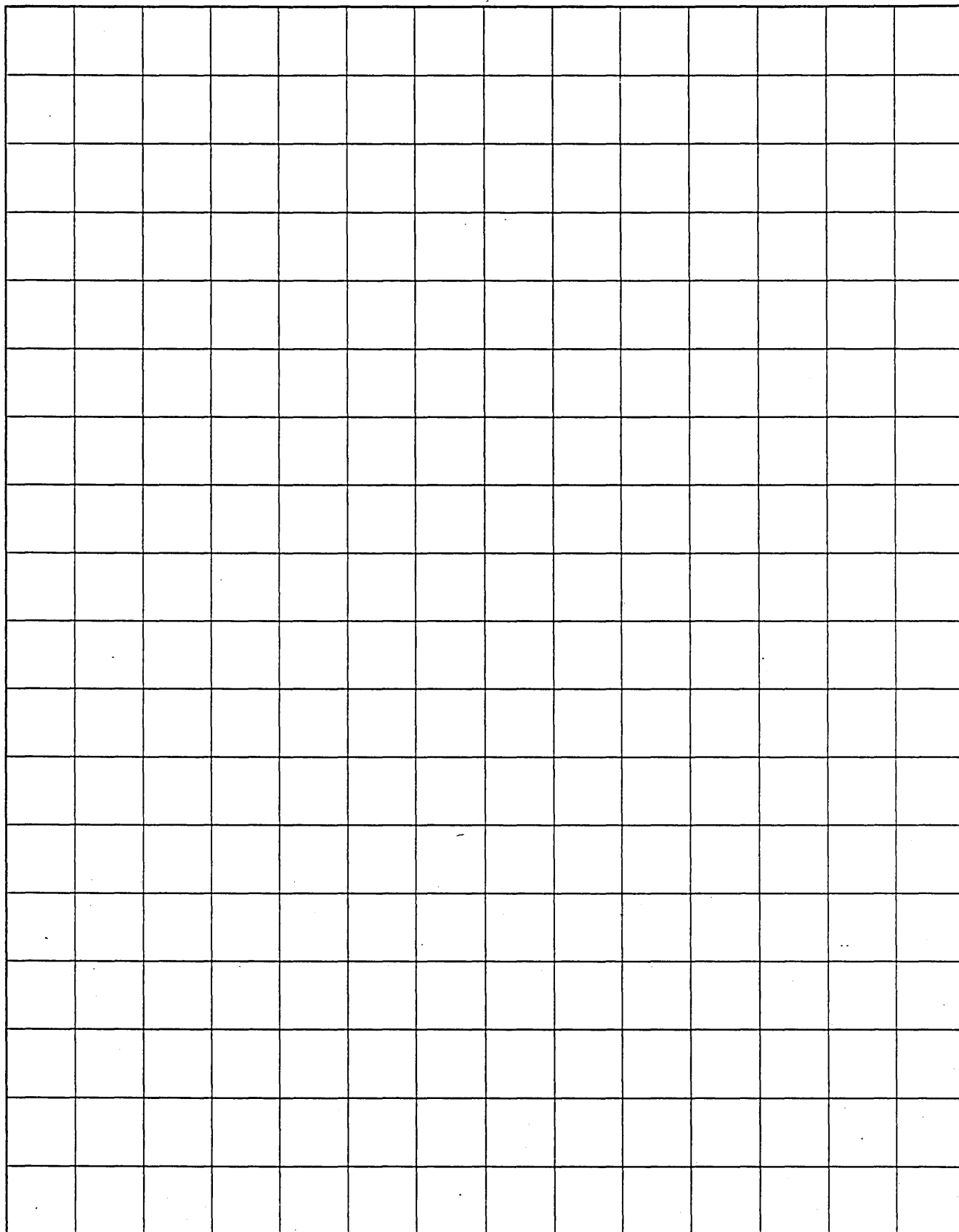
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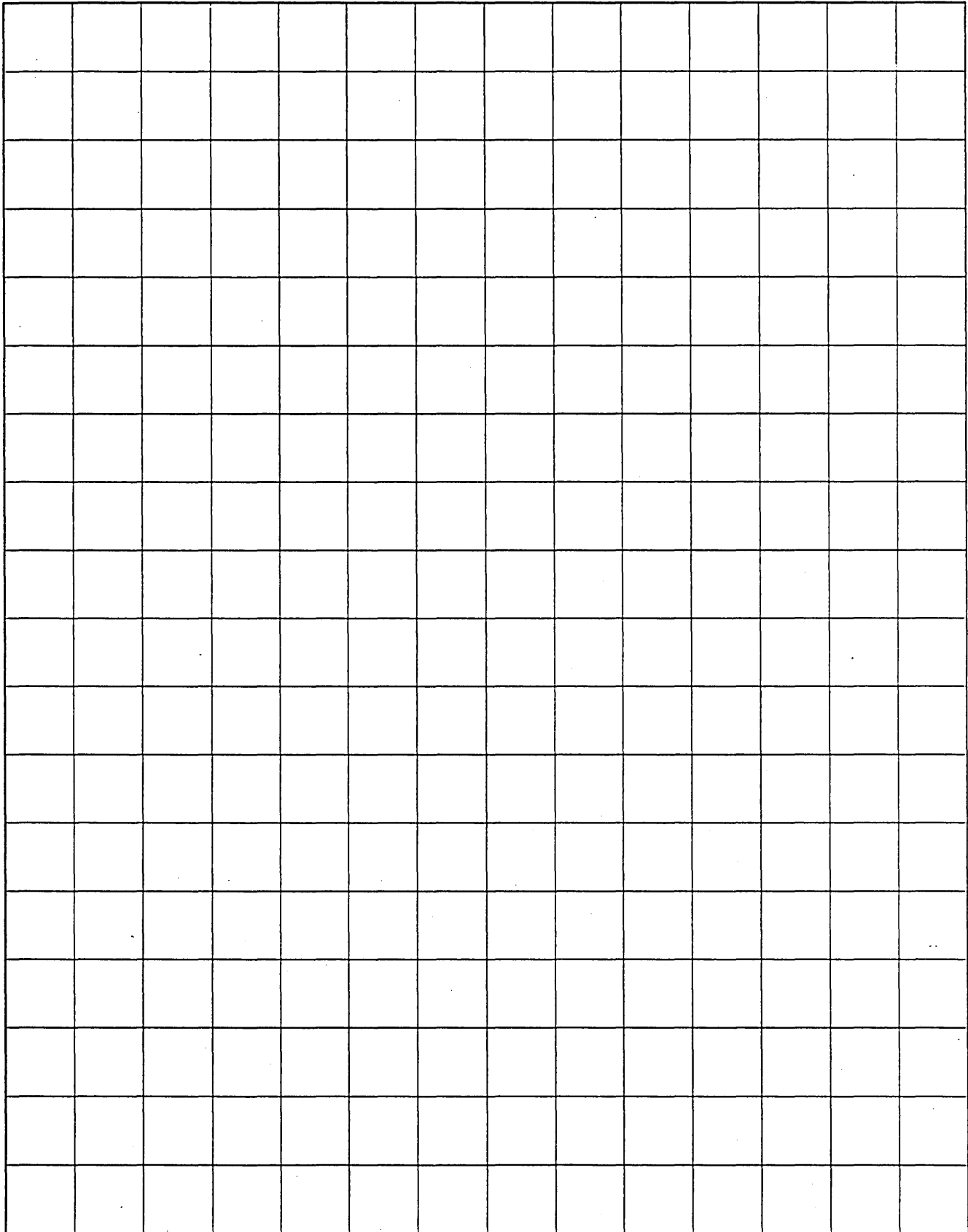
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0 24 48 72

SCALE: 1/2 in = 24 in

60463550-33C

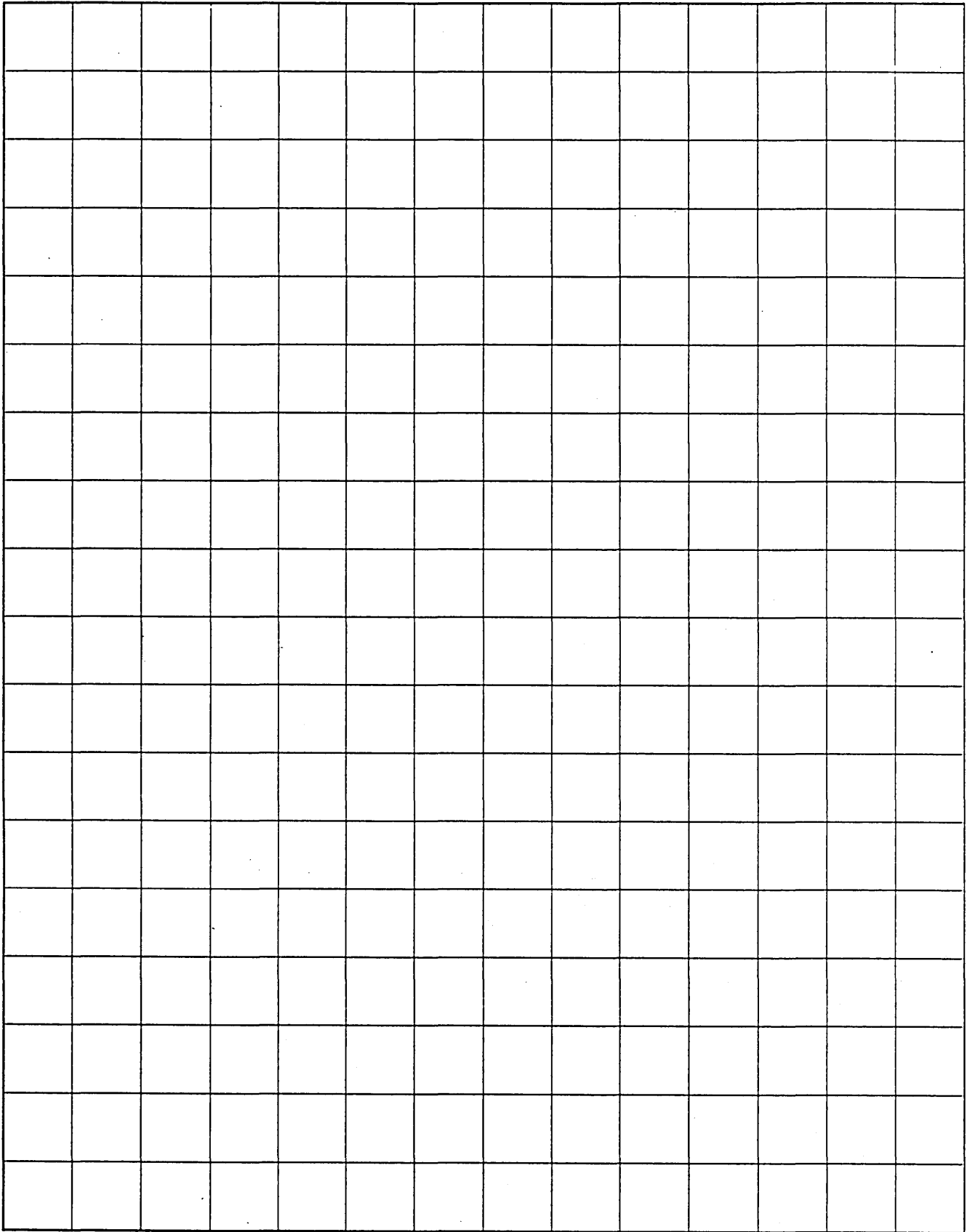


0 24 48 72

A horizontal scale bar with four segments. The first segment is labeled '0', the second '24', the third '48', and the fourth '72'. The bar has a hatched pattern below it.

SCALE: 1/2 in = 24 in

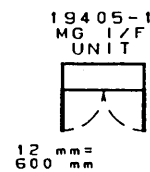
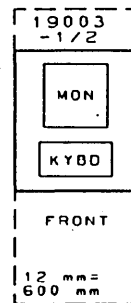
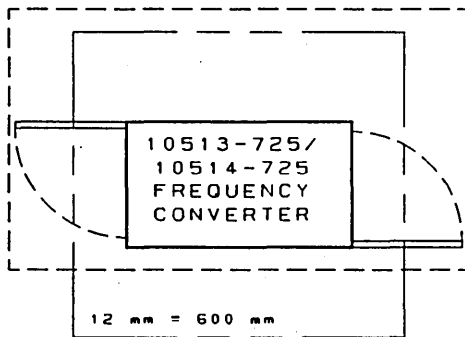
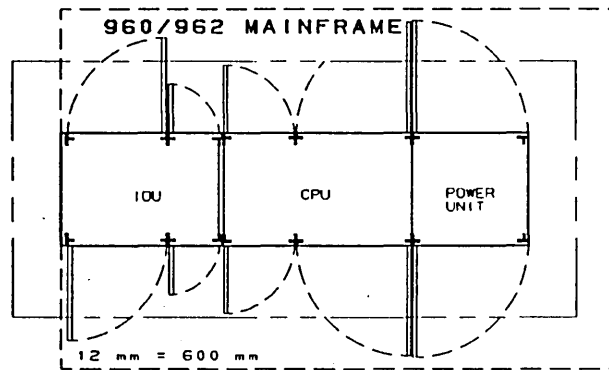
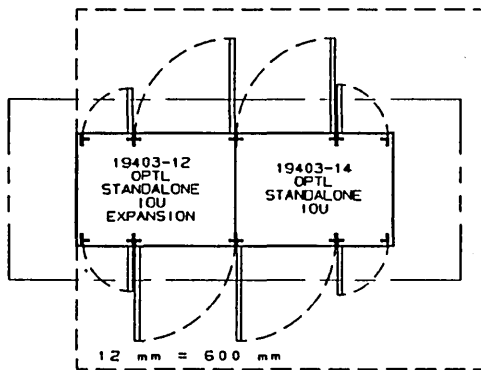
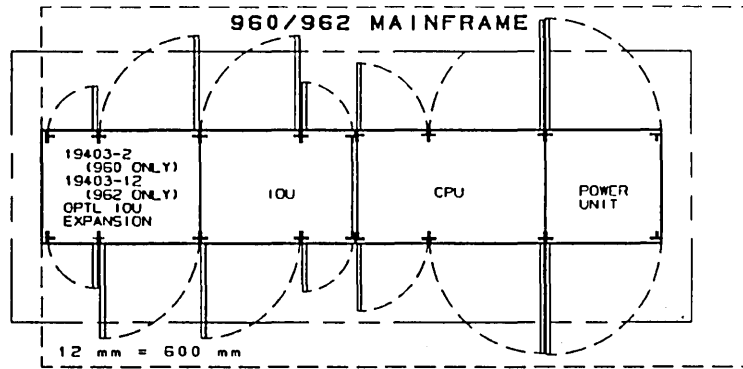
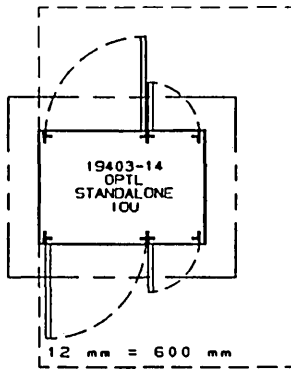
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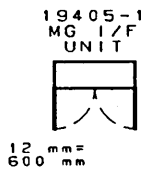
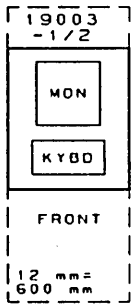
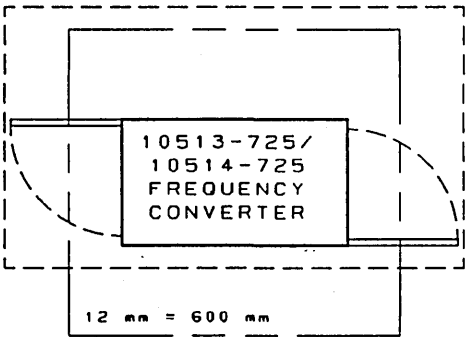
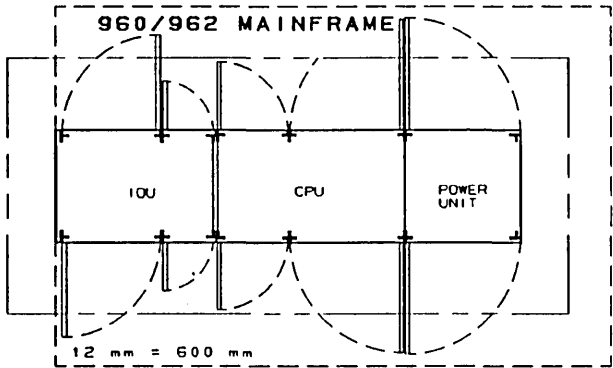
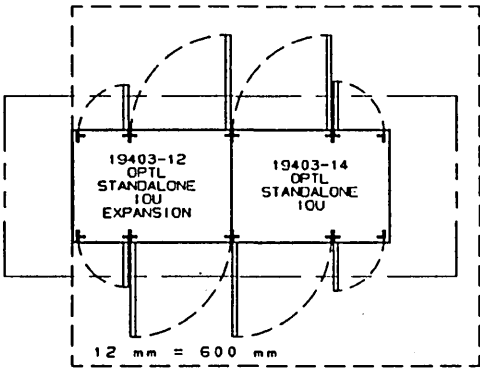
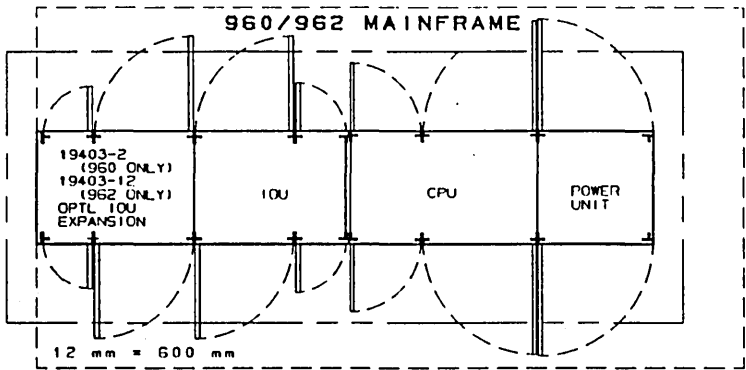
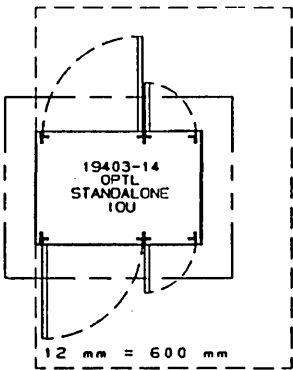
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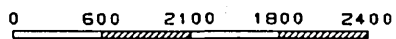
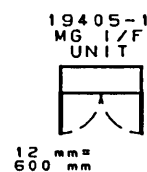
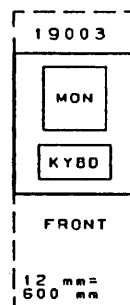
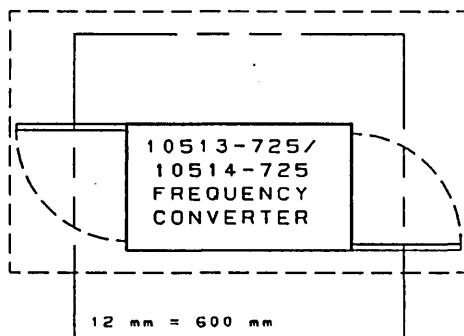
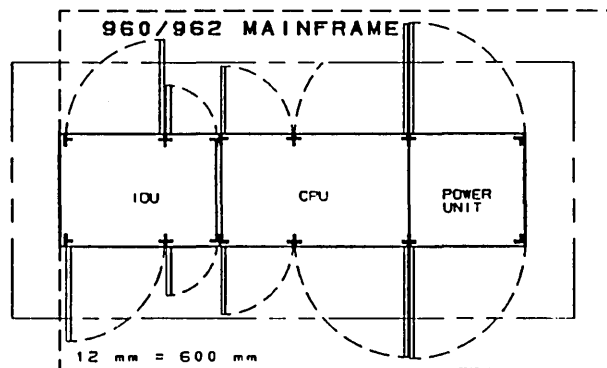
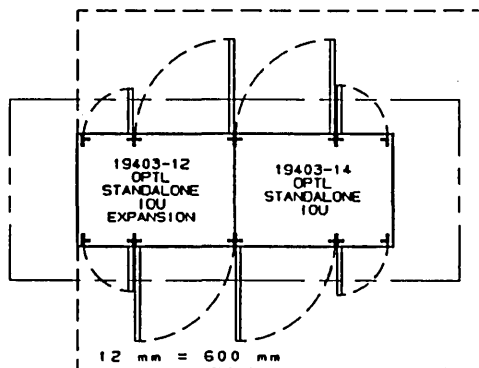
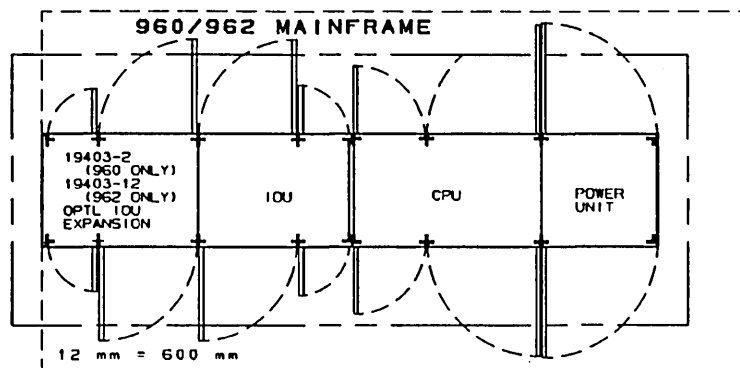
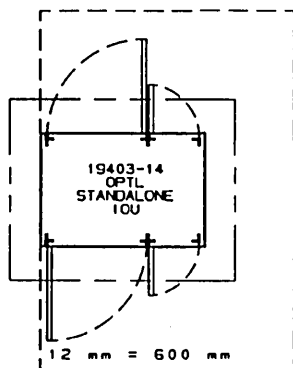
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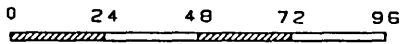
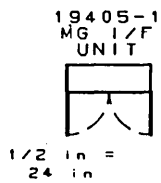
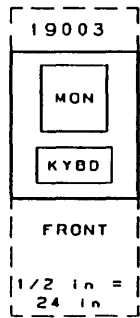
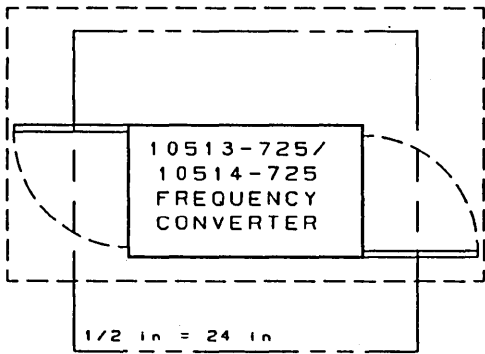
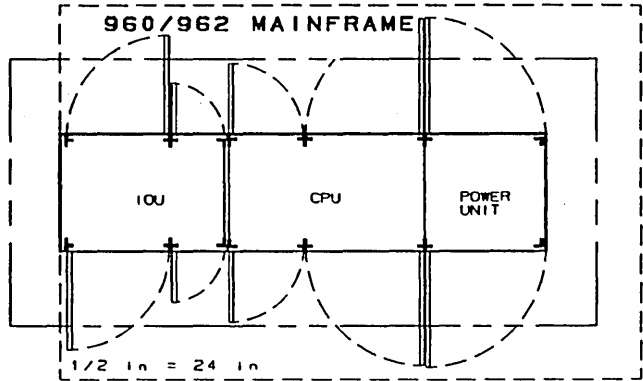
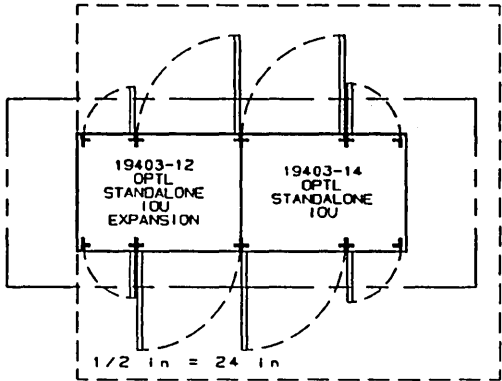
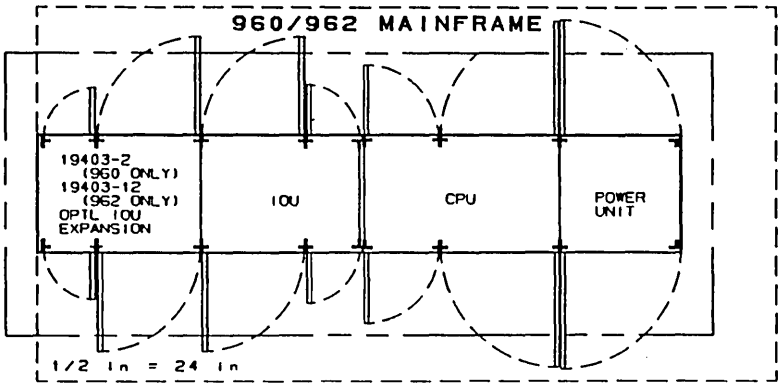
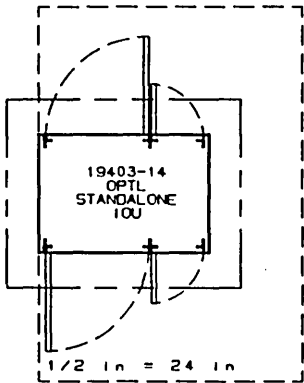
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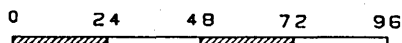
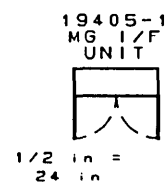
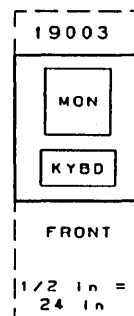
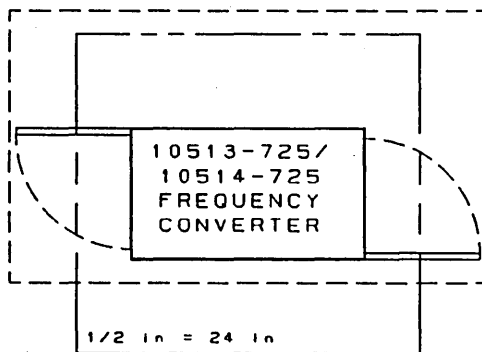
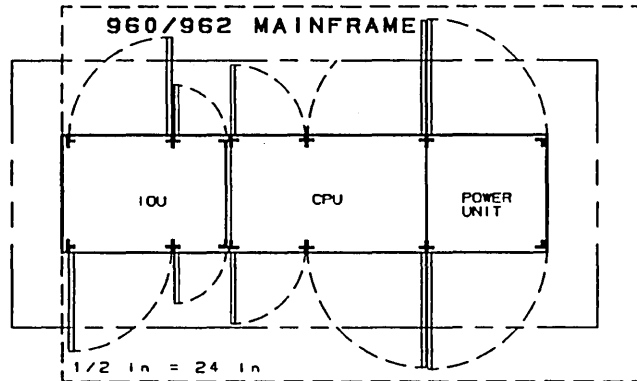
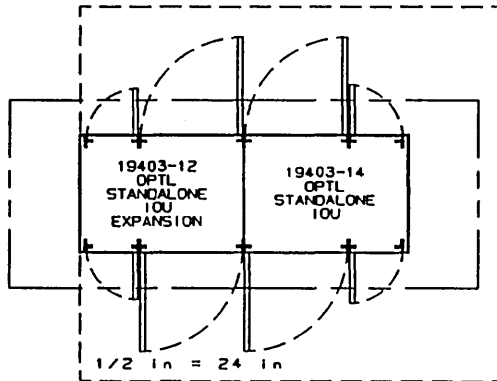
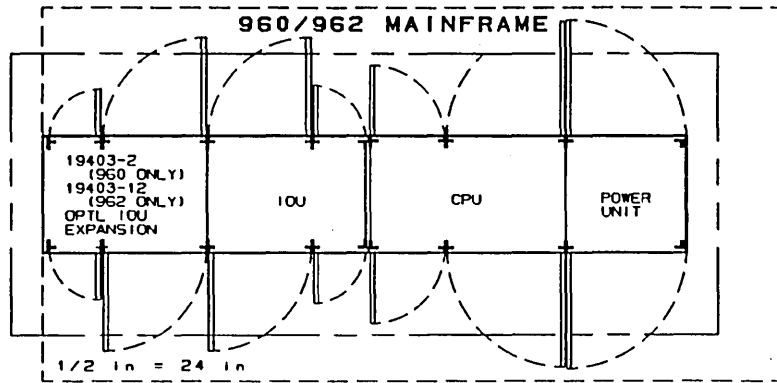
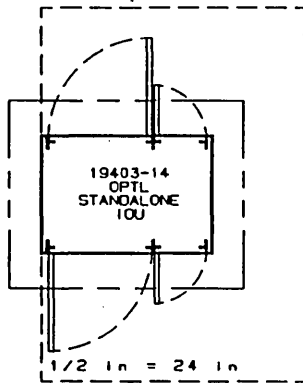
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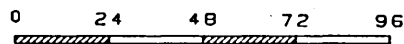
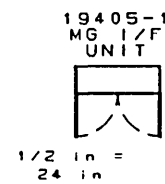
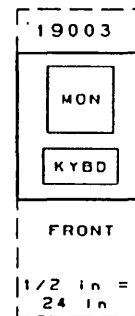
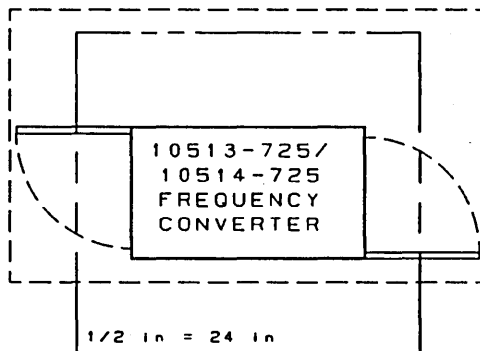
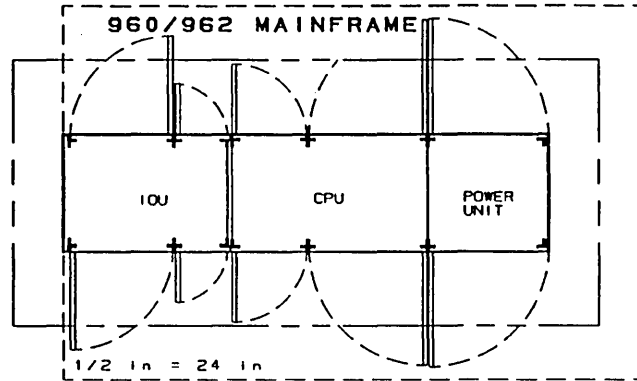
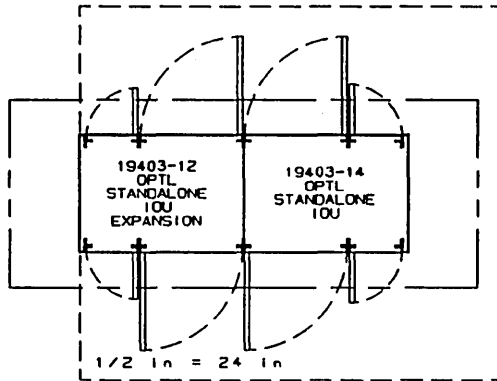
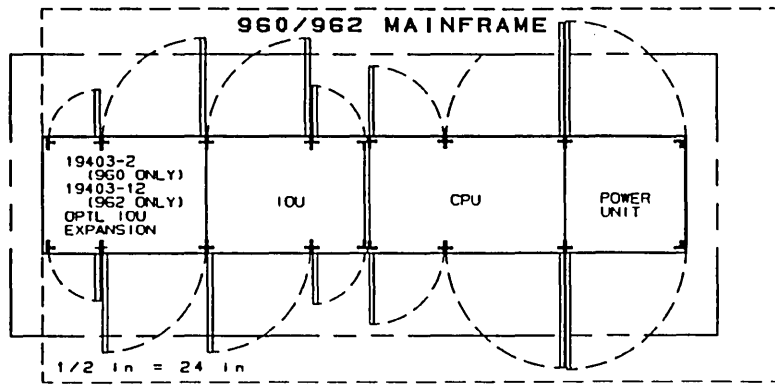
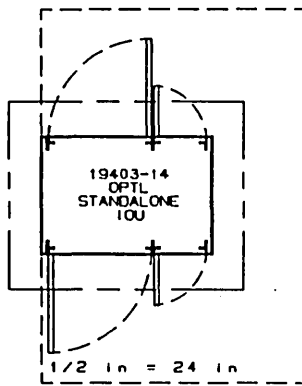
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